RECORD OF DECISION

DEL MONTE CORPORATION

OAHU PLANTATION

SUPERFUND SITE

KUNIA, HAWAII

September 2003

United States Environmental Protection Agency

Region IX - San Francisco, California

Contents

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Acronyms and Abbreviations

AOC	Administrative Order of Consent
ARARs	Applicable or Relevant and Appropriate Requirements
ATSDR	Agency for Toxic Substances and Disease Registry
bgs	below ground surface
BRA	baseline risk assessment
BWS	Board of Water Supply
CAMU	corrective action management unit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COCs	contaminants of concern
COPCs	contaminants of potential concern
CWA	Clean Water Act
DBCP	1,2-dibromo-3-chloropropane
DCP	1,2-dichloropropane
DNAPL	dense nonaqueous phase liquid
EDB	ethylene dibromide
EE/CA	Engineering Evaluation/Cost Analysis
EPA	United States Environmental Protection Agency
ESD	Explanation of Significant Differences
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FS	Feasibility Study
FSA	Fuel Storage Annex
HAR	Hawaii Administrative Rules
HCC	Hawaii Country Club
HDOH	Hawaii Department of Health
HEAST	Health Effects Assessment Summary Tables
HI	hazard index
HQ	hazard quotient
ICR	incremental cancer risk
IRIS	Integrated Risk Information System
kg	kilograms
KVA	Kunia Village Area
LDRs	land disposal restrictions
MCL	maximum contaminant level
MCLG	maximum contaminant level goal
mgd	million gallons per day
mg/kg	milligrams per kilogram (approximately equivalent to parts per million)
µg/L	micrograms per liter (approximately equivalent to parts per billion)
MNA	monitored natural attenuation
msl	mean sea level
MTRs	minimum technology requirements
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
O&M	operations and maintenance
PRG	preliminary remediation goal

PRPs	Potentially Responsible Parties
RAGS	Risk Assessment Guidance for Superfund
RAOs	remedial action objectives
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
RI/FS	Remedial Investigation/Feasibility Study
RME	reasonable maximum exposure
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SDWA	Safe Drinking Water Act
SOW	Statement of Work
SVE	soil vapor extraction
TBC	to be considered
TCLP	toxicity characteristic leaching procedure
TCP	1,2,3-trichloropropane
TPH	total petroleum hydrocarbons
UCL	upper confidence limit
UIC	underground injection control
UST	underground storage tank

Part I
Declaration

Part I - Declaration

1.1 Site Name and Location

This Record of Decision (ROD) addresses soil and groundwater contamination at the Del Monte Corporation (Oahu Plantation) Superfund Site (also listed as the “Del Monte Site” or just the “Site” in this ROD) in Kunia, Hawaii. The Del Monte Corporation (Oahu Plantation) Superfund Site has a CERCLIS ID of HID980637631.

1.2 Statement of Basis and Purpose

This ROD presents the selected remedial action for the Del Monte Corporation (Oahu Plantation) Superfund Site in accordance with the Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 U.S.C. §§ 9601 et. seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) (collectively referred to herein as CERCLA) and to the extent practicable, the National Oil and Hazardous Substances Pollution Contingency Plan, 40 CFR Part 300 (NCP). This decision is based on the Administrative Record for this site.

The State of Hawaii, acting through the Hawaii Department of Health (HDOH), concurs with the selected remedy.

1.3 Assessment of the Site

The U.S. Environmental Protection Agency (EPA) has determined that the pesticides ethylene dibromide (EDB), 1,2-dibromo-3-chloropropane (DBCP), 1,2,3-trichloropropane (TCP) and 1,2-dichloropropane (DCP) have been released into soil and groundwater at the Del Monte Site and that a substantial threat of release to groundwater still exists. The response action selected in this ROD is necessary to protect the public health or welfare or the environment from actual or threatened releases of hazardous substances into the environment.

1.4 Description of the Selected Remedy

This ROD addresses groundwater and soil contaminated with pesticides. The selected remedy will eliminate potential future exposure to contaminants in the Kunia Village Area and the basal aquifer.

EPA’s selected cleanup remedy is divided into two parts: 1) the shallow groundwater (perched aquifer) and contaminated soil in the Kunia Village Area from approximately 20 feet below the ground surface to 100 feet below ground surface and 2) the deep groundwater (basal aquifer). The selected remedy will address contamination through the following actions.

<u>Perched Aquifer and Deep Soil Remedy Components</u>

The contaminated soil in the Kunia Village source area has been designated as a principal threat at the site.

EPA’s goal is to prevent perched aquifer and deep soil contaminants (deeper than 20 feet) from further contaminating the basal aquifer. This will be achieved by extracting and treating contaminated groundwater from the perched aquifer and treating deep soil. Specific components include:

- Pumping contaminated groundwater from the perched aquifer and treating the water using plants (referred to as phytoremediation).
- Placing a vegetated soil covering (a cap) over the contaminated soil area (the source area). The soil cap will reduce the amount of rainwater that moves through the soil and carries contaminants down to the basal aquifer.
- Installing a soil vapor extraction (SVE) system to withdraw contaminants present in vapor form (volatile chemicals) from the soil. The extracted vapor will be treated with a carbon filter to remove the contaminants before the vapor is released to the atmosphere.
- Restricting land use to prevent exposure to contaminated soil and perched groundwater impacted by contaminants of concern (COCs) and to prevent activities that might interfere with the effectiveness of the remedy.

Basal Aquifer Remedy Components

EPA's goal is to prevent future exposure to contaminated groundwater in the basal aquifer. This will be achieved by cleaning up both the source area (including the Kunia Well) and the downgradient plume. Specific components include:

- Installing monitoring wells to characterize the extent of contaminated groundwater in both the source area and the downgradient plume.
- Pumping and treating contaminated groundwater in a phased manner, starting at the Kunia Well.
- Monitoring the effectiveness of source control and evaluating whether natural attenuation is effective at reducing contaminant concentrations in the downgradient plume to drinking water standards.
- If monitoring data show no evidence of natural breakdown, install additional pumping wells to ensure the entire plume is captured and treated.
- Treating the contaminated groundwater to drinking water standards using air stripping and carbon adsorption.
- Using treated groundwater for irrigation.
- Restricting land use to prevent exposure to basal groundwater impacted by COCs and to prevent activities that might interfere with the effectiveness of the remedy.

1.5 Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action, is cost effective, and utilizes permanent solutions and alternative treatment technologies to the maximum extent practicable. This remedy also satisfies the statutory preference for treatment as a principal element of the remedy (i.e., reduces the toxicity, mobility, or volume of hazardous substances, pollutants, or contaminants through treatment), including treatment of the principal threat deep soil in the Kunia Village Area.

Because this remedy will not result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure, but it will take more than five years to attain remedial action objectives and cleanup levels, a policy review may be conducted within five years of construction completion for the Site to ensure that the remedy is, or will be, protective of human health and the environment.

1.6 ROD Data Certification Checklist

The following information is presented in the Decision Summary section of this ROD. Additional information can be found in the Administrative Record file for this site.

- COCs and their respective concentrations (see Part II, Sections 5.5 and 7.1)
- Baseline risk represented by the COCs (see Part II, Section 7.1)
- Cleanup levels established for the COCs and the basis for these levels (see Part II, Section 8)
- How source materials constituting principal threats are addressed (see Part II, Section 11, page 1)
- Current and future land and groundwater use assumptions used in the baseline risk assessment (BRA) and ROD (see Part II, Sections 6.2 and 7.1)
- Land and groundwater use that will be available at the site as a result of the selected remedy (see Part II, Section 11.3)
- Estimated capital, operation and maintenance (O&M), and total present worth costs; discount rate; and the number of years over which the remedy cost estimates are projected (see Part II, Section 11.2)
- Decisive factors that led to selecting the remedy (i.e., how the selected remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria) (see Part II, Section 11)

______________________________________ _______________

Joel Jones, Acting Chief — Date
Federal Facility Cleanup Branch

Original signed by Joel Jones on September 25, 2003.

Part II
Decision Summary

Part II - Decision Summary

This Decision Summary portion of the ROD summarizes the information and approaches that EPA used to reach a decision on this remedy. It also establishes the remedy that EPA has selected.

1 Site Name, Location and Description

This ROD presents the selected remedial action to address soil and groundwater contamination at the Del Monte Corporation (Oahu Plantation) Superfund Site (CERCLIS ID of HID980637631) located in Kunia, Hawaii on the island of Oahu. The Del Monte Site is part of a large pineapple plantation that is currently operated by Del Monte Fresh Produce (Hawaii), Inc. The northeastern portion of the Site (known as the "Poamoho Section") is owned by the Galbraith Trust and the remainder of the Site (known as the "Kunia Section") is owned by the Estate of James Campbell. Del Monte Fresh Produce (hereinafter referred to as "Del Monte") leases the Poamoho Section and the Kunia Section.

EPA is the lead regulatory agency overseeing the cleanup at the Del Monte Site. The Hawaii Department of Health (HDOH) is the lead agency for the State of Hawaii and provides support to EPA's efforts. Del Monte conducted the Remedial Investigation and Feasibility Study (RI/FS) in accordance with an Administrative Order of Consent (AOC) they signed with EPA and HDOH. EPA expects to negotiate and sign a consent decree with Del Monte to implement the remedial action described in this ROD.

The Oahu Plantation is a 6,000-acre pineapple plantation currently operated by Del Monte. The plantation is located on the western side of the Oahu central plain which stretches between the Waianae and Koolau Mountain ranges (Figures 1 and 2). The plantation has been used for cultivation of pineapple since the early 1940s. During that time, a number of chemicals were applied to the soil to kill nematodes (worms that attack pineapple roots). The facility is comprised primarily of agricultural areas but also contains two company operated housing complexes (Kunia Village and Poamoho Village [see Figure 2]), as well as equipment maintenance areas, pesticide storage facilities, warehouses, and administrative buildings.

2 Site History and Enforcement Activities

2.1 Site History

From 1946 through April 25, 1980, the Kunia Well (State Well No. 2703-01) (Figure 3) supplied domestic water to the approximately 700 residents of Kunia Village as well as agricultural water to the plantation. In April 1977, an accidental spill involving about 495 gallons of the soil fumigant EDB containing 0.25 percent DBCP occurred on bare ground within approximately 60 feet of the Kunia Well. The spill resulted from the failure of a hose connector on a bulk transport container owned by Dow Chemical Company during transfer operations to an above ground storage tank. EDB contamination was not detected (detection limit of 0.5 micrograms per liter [µg/L]) in the Kunia Well in testing conducted by the HDOH within one week of the spill. However, groundwater samples collected from the Kunia Well on April 14, 1980 indicated the presence of EDB and DBCP at levels of 92 and 11 µg/L, respectively. The Kunia Well was re-sampled on April 24, 1980, and EDB and DBCP were detected at 300 and 0.5 µg/L, respectively. The State of Hawaii's Safe Drinking Water Standards for both EDB and DBCP are 0.04 μg/L. Del Monte immediately disconnected the Kunia Well from the Kunia Village drinking water system.

In response to the detection of the compounds in the Kunia Well, the operator of the plantation at the time, Del Monte Corporation, initiated soils and groundwater investigations to determine the extent of contamination in the spill area and adjacent areas where pesticides had been stored and mixed. In addition to the Kunia Well spill area, other areas impacted with fumigants near the well were identified, including the Former Fumigant Mixing Area and Former Fumigant Storage Area (Figure 4). These areas are located within about 50 to 150 feet northwest of the Kunia Well. The nature of accidental spillage near the former mixing and storage areas may have been intermittent over a span of years, and the quantity of accidental spillage in these areas is unknown.

Based on these investigations, 2,000 tons of contaminated soil were removed from the EDB spill area in 1981, and 16,000 tons of contaminated soil were removed from the former pesticide mixing and storage areas in 1983 (Figure 4). These soil removal activities resulted in the creation of a 60-foot deep by 75-foot-wide by 75-foot long excavation pit. The excavated soil was spread on a nearby field. With EPA's approval, the pit was backfilled in October 1999 (Del Monte Fresh Produce, 1999). In addition, three groundwater extraction wells were installed into the shallow, perched aquifer and pumped periodically from 1980 to 1994. The Kunia Well was also pumped periodically during this time period. The extracted perched groundwater was used for dust control on in-field pineapple roads away from residential populations. Groundwater pumped from the Kunia Well was used for non-crop irrigation of a grass covered field approximately 350 feet north of the Kunia Well site. In September 1994, EPA requested that Del Monte cease pumping of the Kunia Well and perched groundwater wells due to concerns regarding use of the extracted water.

A Preliminary Assessment/Site Investigation was conducted by EPA at the site in 1990. EPA subsequently completed a Hazard Ranking Scoring process for the site in 1992, which led to a proposed listing on the National Priorities List (NPL). During 1994, a public health assessment was conducted by the Agency for Toxic Substances and Disease Registry (ATSDR) pursuant to requirements mandated by the proposed listing on the NPL. The ATSDR studied the historical data for the site, including the pre-1980 use of the Kunia Well as the drinking water source. In a report dated February 7, 1995, ATSDR concluded that residents of Kunia Village had not been exposed to significant levels of EDB and DBCP in their drinking water, and the Oahu Plantation was classified as a “No Apparent Public Health Hazard” for past and current conditions (ATSDR, 1995). It is not anticipated, according to ATSDR, that Kunia Village residents who utilized the Kunia Well, as their drinking water source will have any adverse health effects. ATSDR also concluded that the site may pose an “Indeterminate Health Risk,” for future exposures because of the need to characterize potential impacts on downgradient wells. The site was added to the NPL on December 16, 1994.

2.2 Remedial Investigation Activities

EPA developed the Remedial Investigation (RI)/Feasibility Study (FS) process for conducting environmental investigations under Superfund. The RI/FS approach is the methodology that the Superfund program has established for characterizing the nature and extent of risks posed by uncontrolled hazardous waste sites to evaluate potential remedial options. The remedial investigation (RI) serves as a mechanism to collect data for site characterization. The Feasibility Study (FS) serves as the mechanism for development, screening, and evaluation of potential remedial alternatives.

An AOC for an RI/FS and Engineering Evaluation and Cost Analysis (EE/CA) was signed by Del Monte, EPA, and the State on September 28, 1995. EPA and Del Monte agreed on January 23, 1997 to include the soils operable unit in the FS rather than in a separate EE/CA to more effectively complete the remedial evaluation process by considering interactions of soils and groundwater. The AOC Statement of Work (SOW) developed by EPA and the State describes the investigative work at the Kunia Village Area and Other Potential Source Areas required to meet the RI/FS objectives.

The overall goal of the RI field sampling activities was to estimate the nature and extent of impacts from chemicals of potential concern (COPCs) at known and suspected source areas, and to characterize the chemicals present in sufficient detail to prepare a Baseline Risk Assessment (BRA) and FS. Data that are required to support these goals include information on geology, hydrogeology, soils, surface water and sediments, and the nature and extent of chemicals throughout pertinent environmental media. The RI is summarized in Section 2.1. Subsequent to completion of the RI, additional site characterization was conducted and reported to EPA in an addendum to the RI (Golder, 2002a) and in RI Technical Memorandum 02-02 (Golder, 2003b).

The rationale and approach for site field investigations were evaluated in the *Work Plan for Remedial Investigation and Feasibility Study at the Del Monte Corporation (Oahu Plantation) Superfund Site* (ICF, 1997). The Work Plan identified the following “known” sources (where chemicals have been observed) which are collectively referred to as the Kunia Village Area (KVA):

- Kunia Well Spill Area;
- Former Fumigant Storage Area; and
- Former Fumigant Mixing Area.

Additionally, suspected sources of potentially hazardous chemicals (Other Potential Source Areas) were selected by EPA and identified in the RI/FS Work Plan. Releases of potential hazardous chemicals were not known to have occurred at these areas, but were suspected based on historical activities. These known and suspected source areas were investigated in the RI.

Remedial Investigation activities were performed during March through June of 1997 and during August through October 1997. Subsequent RI data were also collected in May of 1998 and July/August 1998. RI results were compiled and presented in the *Remedial Investigation Report for the Del Monte Corporation (Oahu Plantation) Superfund Site* (Golder, 1998a). The RI Report was approved by EPA in February 1999. From 2000 to 2001, Del Monte conducted a supplemental investigation in the Kunia Village Area of the site subsequent to the RI Report. These additional data were reported to EPA in an addendum to the RI (Golder, 2002a). In late 2002 and early 2003, Del Monte conducted supplemental investigations in the Poamoho Section. These data were reported to EPA in Remedial Investigation Technical Memorandum 02-02 (Golder, 2003b).After the RI, the FS along with the BRA represent the next steps of the RI/FS process. Based on the information presented in the RI, the BRA evaluates potential human health and environmental risks posed by COPCs characterized in the RI. The FS identifies and evaluates potential remedial measures needed to address any applicable or relevant and appropriate requirements (ARARs) or risks identified in the BRA. The BRA was submitted to EPA on December 17, 1999 with minor revisions submitted May 18, 2000. The FS was prepared in accordance with the AOC, the statutory requirements of CERCLA, and the *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA* (EPA 1988b). The FS identified remedial action objectives, assembled remedial action alternatives, and provided an evaluation of the remedial action alternatives using the Superfund evaluation criteria established in the NCP. The final FS (Golder, 2003a) was submitted to EPA in February 2003.

2.3 Enforcement Activities

On November 25, 1994, EPA signed a memorandum of action with the State of Hawaii whereby EPA agreed to assume the lead agency role with respect to the Site. On April 7, 1995 and April 20, 1995, General Notice letters were sent by EPA to identified current and former owner/operators of the Site notifying such parties that they might be potentially responsible parties (PRPs) with respect to the Site. On April 28, 1995, EPA sent Special Notice to the PRPs inviting them to participate in negotiations with EPA to conduct the Del Monte Site RI/FS. One of the PRPs, Del Monte, entered into negotiations with EPA. In September 1995, Del Monte signed an AOC with EPA and the State of Hawaii to conduct the RI/FS.

3 Community Participation

The Proposed Plan for this remedy, in the form of a fact sheet, was distributed to the parties on EPA's mailing list for the Del Monte Site in March 2003. The Proposed Plan, together with the final RI Report (Golder, 1998a) and FS (Golder, 2003a) reports and other pertinent documents, were also included in the Administrative Record file available at EPA's Superfund Records Center at EPA's Regional Office in San Francisco and locally at the Del Monte Site Information Repository at the Wahiawa Public Library. The Administrative Record for the Del Monte Site was placed in CD-ROM format in the repository

EPA held a public meeting to present the Proposed Plan and EPA's preferred alternative on April 2, 2003, at the Wahiawa Intermediate School Library in Wahiawa, Hawaii. At this meeting, EPA answered questions and accepted oral comments pertaining to the Del Monte Site and the preferred alternative. A transcript of this meeting is available at the EPA's Superfund Records Center and at the information repository.

Notice of EPA's public meeting, availability of the Proposed Plan, and the announcement of a 30-day public comment period was published in the Honolulu Advertiser on March 19, 2003.

The public comment period ran from March 19 to April 18, 2003. EPA received one written comment during the public comment period. This comment and the substantive oral comments are addressed in the Responsiveness Summary, included as Part III of this ROD.

4 Scope and Role of Response Action

The Del Monte Site remedial action selected in this ROD is expected to be the only action required at the Site and will result in remediation of the impacted soil and groundwater. Based on the findings of the RI and the BRA at the site, the only areas and media requiring a response action are:

- Subsurface soil (greater than 20 feet below ground surface) in the Kunia Village source area (designated as a principal threat at the site),
- Shallow, perched groundwater in the Kunia Village source area,
- Deep, basal aquifer groundwater in the Kunia Village source area, and
- The basal aquifer plume that has migrated downgradient of the source area.

Although there is no current exposure to contaminants in these areas/media, there is a potential future risk of exposure to contaminated groundwater if these areas/media are not remediated. Each of these areas/media are addressed by the remedy selected in this ROD, including treatment of the subsurface soil in the source area which has been designated as a principal threat.

Based on the findings of the RI, no COCs were detected above EPA Region IX residential Preliminary Remediation Goals (PRGs) in the Poamoho Section . EPA's PRGs are developed based on potential human health impacts and are commonly used as screening-level values for comparison to site-specific concentrations detected during RI activities. Because of these findings, EPA plans to propose a Partial Site Deletion to remove the Poamoho Section from the NPL. The Partial Site Deletion will be published in the Federal Register following a public comment period.

Although this ROD includes the only action expected to be necessary under CERCLA to cleanup the Del Monte Site, before the Site was listed on the NPL in 1994, several remedial actions were implemented by the owner, with oversight by the State of Hawaii. These actions included removal of 18,000 tons of soil from the Kunia Village source area and periodic extraction of contaminated groundwater from the shallow (perched) and deep (basal) groundwater systems in the source area.

5 Site Characteristics

Most of the site characteristic information presented in this section is summarized from the RI and FS Reports (Golder 1998a and 2003a, respectively).

5.1 Location and Setting

The Oahu Plantation is a 6,000 acre pineapple plantation located on the north-central plateau of the Island of Oahu (Figures 1 and 2). The facility is approximately 15 miles from the City of Honolulu, and the closest town is Wahiawa. Schofield Army Barracks and Wheeler Military Airfield are located in close proximity to the plantation.

The plantation is located within the Schofield Plateau physiographic province which is bounded on the east by the Koolau Mountain Range and on the west by the Waianae Mountain Range (Figure 1). The Schofield Plateau was formed by the burial of older Waianae lavas by the younger lavas of the Koolau volcano. The surface topography of the plateau ranges from nearly flat near the central area around the Wheeler Military Airfield (Figures 1 and 2) to steeply sloping, dissected terrain rising up to the mountain ranges east and west of the plateau. The crest of the plateau runs through the Schofield Barracks and forms a natural drainage divide for the island. North of the divide, watercourses flow to the north, and south of the divide, they flow to the south to the west loch of Pearl Harbor. Narrow gulches dissect the plateau where streams have eroded the land surface.

The Oahu Plantation facility is an agricultural operation currently managed by Del Monte. While comprising primarily agricultural areas, the facility also contains two company operated housing complexes (Kunia Village and Poamoho Village), equipment maintenance areas, chemical storage areas, warehouses, and administrative buildings. A fresh pineapple packing facility is located within the property boundaries.

The plantation can be geographically divided into two major sections: the Kunia Section and Poamoho Section (Figure 2) located on either side of the Schofield Plateau drainage divide and separated by an active military reservation, the Schofield Barracks. Pineapple production occurs in both sections. The northern section (Poamoho Section) is a relatively flat area located to the north of Wahiawa and Schofield Barracks. One of the company operated housing complexes (Poamoho Village) is situated adjacent to the northern section. The section is bounded by Wahiawa Reservoir (Lake Wilson) to the south, Kaukonahua Gulch to the east and Poamoho Gulch to the north. State Highways 80, 82, and 99 cross this parcel of land. The Poamoho Section is located approximately 3 miles north of the known source areas near the Kunia Well.

The southern parcel of land, which includes most of the areas investigated during the RI, is centered around Kunia Village (Figures 2 and 3). The land in this parcel gently slopes to the east and southeast from a maximum elevation of about 1,200 feet to about 750 feet above mean sea level (msl). The parcel is bounded by Waikele Stream Gulch to the north and by the Schofield Barracks and Honouliuli Forest Preserve to the west. State Highway 750 (Kunia Road) crossed through this parcel of land.

The Kunia Section is the largest section of the plantation and contains the Kunia Well site. With the exception of 4 small Other Potential Source Areas, all of the known Other Potential Sources Areas are located in the Kunia Section. The 1977 EDB Spill Area and the Former Fumigant Storage and Mixing Areas are located within the area collectively referred to in this document as the KVA. The results of the

RI indicate that all of the known source areas for the NPL site area located within the Kunia Village Area of the Kunia Section of the Oahu Plantation.

A topographic survey of the KVA was conducted as part of the RI. The Spill Area and Kunia Well are situated atop relatively level ground at a surface elevation of about 850 feet above msl. Because of earlier soil excavation activities, the Spill Area slopes gently to the north before dropping steeply approximately 30 feet to the Former Mixing Area. In 1983, approximately 16,000 tons of soil were excavated from the Former Mixing Area to remove impacted soils. The excavated area was approximately 60 feet deep at the center, however, over the years sediment and fill material reduced the total depth of the excavation. The soil removal activities resulted in near vertical side walls around the excavation pit. Immediately after the completion of excavation activities, a fence was constructed around the excavation area and the Former Storage Area to restrict access.

The entire fenced area around the pit (Figure 4) drains generally towards the excavation, which filled with water during periods of heavy rainfall. Collected water then infiltrated into perched groundwater contributing to the migration of chemicals from the perched to the basal aquifer. With EPA's approval, the pit was backfilled in October 1999. An ephemeral watercourse (gulch), which drains upland areas including pineapple fields o the west, runs outside of the northern side of the fenced area and discharges through a culvert running underneath Kunia Road into previous pineapple fields and eventually to Poliwai Gulch and Waikele Stream.

The Poliwai Gulch is normally dry, covered with grasses and trees, and is bermed at the last pineapple field to prevent stormwater runoff. The distance from the fenced area to Waikele Stream is approximately 1.5 miles, and the distance from the confluence of Poliwai Gulch and Waikele Stream to Pearl Harbor is approximately 3.5 miles.

5.1.1 Meteorology

The Island of Oahu, which lies south of the Tropic of Cancer and within the belt of northeast trade winds, is characterized by moderate temperatures that remain relatively constant throughout the year. The mean average temperature near sea level in Honolulu is 77.2 degrees. The lowest temperature ever recorded is 53 degrees and the highest is 95 degrees. The average daily temperature range in Honolulu is about 14 degrees. January and February are the coldest months and average about 73 degrees. August is the warmest at about 81 degrees. The decrease in temperature with increasing altitude is about 3 degrees per thousand feet. Temperatures at Oahu Plantation would therefore be expected to be about 3 degrees cooler than in Honolulu.

The mean maximum relative humidity in Honolulu is about 76% and the mean minimum is 59%. The mean wind speed is 11.3 miles per hour and the prevailing wind direction is east-northeast, the direction of the trade winds.

Rainfall on Oahu is as little as 20 inches on the extreme leeward (or western) coast and as much as 300 inches at the crest of the Koolau Range. In general, rainfall decreases progressively from the mountains to the sea.

Trade wind circulation results in greater amounts of rainfall on windward Oahu than leeward Oahu. Rainfall in the Waianae Range is considerably less than the Koolau Range because the trade wind air has lost much of its moisture to the Koolau Range before it reaches the slopes of the Waianae Range. The occurrence of groundwater resources on Oahu is the direct result of rainfall infiltration. Due to the much higher amounts of rainfall in the Koolau Range as compared to the Waianae Range, most of the recharge to basal groundwater is associated with the Koolau Range.

Based on data from a rain gauge located at the Kunia Well site, average rainfall for the Kunia Village Area is about 36 inches per year, with October through March the wettest months at about 4 to 5 inches per month and April through September the driest at about 1 to 2 inches per month. Over 50 inches of rain fell during a period of prolonged storms from November 1996 through March 1997 resulting in an exceptionally high stormwater level in the excavation pit.

The evaporation rate in the area is high. The average monthly potential evaporation exceeds average monthly rainfall from about April through October.

5.1.2 Surface Water

No permanent stream, springs, seeps or natural surface water bodies exist or were identified during the RI within at least 2 miles of the Kunia Well site. A 2.4-million gallon man-made irrigation basin is located within the plantation roughly one mile to the northwest of the Kunia Village. The nearest permanent natural surface water body is Lake Wilson (Wahiawa Reservoir) located approximately 3 miles northeast of the Kunia Well site.

At the Kunia Village Area, an unnamed ephemeral gulch skirts the northern fenced boundary of the pit area and flows through a culvert under Kunia Road, eventually discharging into Poliwai Gulch, and Waikele Stream. This ephemeral gulch flows only intermittently during periods of heavy rainfall. A narrow ravine, located between the Kunia Well and Kunia Road, does not represent a distinct stormwater drainage path. No stormwater flow was observed from the ravine even during the exceptionally high rainfall that occurred during the RI sampling.

Water that periodically flows in the ephemeral gulch north of the pit area is not representative, or contiguous with, the perched groundwater in the Kunia Village Area. Leakage of groundwater contributes little, if any, to streamflow, and surface water streams in the region are believed to contribute little recharge to groundwater, primarily because of the low-permeability clay-rich soils. Water level measurements collected from wells in the pit area during the RI confirm that water in the gulch is not comprised of perched groundwater discharge. Perched groundwater levels were much lower than the ephemeral gulch bed elevation.

The excavation pit in the Former Fumigant Mixing Area was backfilled during October 1999. Previous to that, surface water in the pit area would drain towards the pit and the pit would fill during periods of heavy rainfall. During unusually high rainfall events, such as were observed during the RI, the level of water in the pit could rise high enough to spill out and discharge from the pit area to the ephemeral gulch.

5.2 Geology

The Island of Oahu is comprised of the remnants of two late Tertiary shield volcanoes and their associated rift zones. The western part of the island is the eroded Waianae volcano (about 3 million years old), which was the first of the two volcanoes to emerge above sea level; the eastern part of the island consists of the eroded dome of the Koolau volcano (about 2 million years old). The Waianae dome, because of its earlier emergence, was deeply eroded before the Koolau dome reached its maximum height. Piling up of lavas from the Koolau dome occurred on top of the older, eroded slopes of the

Waianae dome and eventually produced the broad gently sloping feature in the central area of Oahu called the Schofield Plateau.

Geologic materials present in the vicinity of the KVA include Waianae basalts to the west, Koolau basalts to the east and, directly underlying the KVA, the weathered remnants of basaltic lavas. The surface contact of the Waianae basalts is some 4,000 feet to the west of the KVA. The dip of the Waianae basalts located to the west of the KVA is variable, but is generally about 8º (to the east).

Near surface materials consist primarily of the weathered remnants of the original basaltic surface. In situ decomposition of basaltic bedrock has progressed to depths of approximately 100 to 200 feet bgs. Near surface soils consist of several feet of a deep-red lateritic soil lithosol having a loose, and generally porous structure. Underlying the surface soil is the subsoil, which extends to depths of about 10 to 30 feet. The subsoil is similar to the surface soil in texture and mineralogy, but has larger and more distinct structural units. The subsoil grades with depth to saprolite, which is a highly weathered basalt that retains some textural and structural features of the parent rock, such as vesicles, fractures and relict minerals. Saprolite is a clay-rich thoroughly decomposed rock formed by in-situ weathering of the basalt. Beneath the saprolite lies basalt. In places, the basalt immediately beneath the saprolite exhibits some moderate weathering. This zone of weathered basalt is a transitional zone between the highly weathered saprolite and fresh basalt.

As basalt weathers to saprolite, its pore structure is altered and, generally, permeability is decreased as secondary clay minerals fill in pore spaces. In some areas, the permeabilities are low enough to create locally perched water tables within the saprolite zone. The saprolite generally has a thickness of about 50 to 150 feet.

In the vicinity of the KVA, this sequence of surface soil, subsoil and saprolite is typical and generally mantles the basalt which is encountered at depths of approximately 150 to 200 feet bgs. Beneath the saprolite lies the moderately weathered basalt and unweathered basalt, which comprises the remainder of the unsaturated zone and basal aquifer. A generalized geologic cross section is shown in Figure 5.

The saprolites of the KVA are believed to be underlain by basalts of the Koolau volcanic series, given the location of the surface contact of the Waianae some 4,000 feet to the west. The contact between the Koolau and Waianae basalts therefore is present at depth beneath the KVA. The depth to the contact between the basalts has not been previously defined for the KVA. Based on a projection of the surface contact of the Waianae basalts, however, and assuming a dip of approximately 8º to the east, the contact between the Waianae and Koolau basalts is believed to occur no deeper than about 500 to 600 feet bgs. This places the contact between the Koolau and Waianae lavas at an elevation above the water table surface, which occurs at about 825 feet bgs. Therefore, the basal aquifer in the KVA is located within the Waianae basalts.

5.3 Hydrogeology

The most extensive bodies of freshwater on Oahu occur as basal groundwater. Basal groundwater occurs when fresh water percolates into the saturated zone and displaces the underlying seawater. The accumulating fresh water forms a lens-shaped body with a surface that extends above the surface of the salt water due to the contrast in densities between freshwater and seawater. The water table or potentiometric surface of a basal-water body is typically rather flat and is no more than several feet to several tens of feet above sea level. The predominant volume of the freshwater body lies below sea level.

The lavas from the Koolau volcano have the greatest areal extent on Oahu and comprise the largest and most significant basal aquifers. Lavas from the Waianae volcano also comprise significant aquifers. The permeability of the unweathered rock that makes up the basal aquifers is generally high. The principal flow structures contributing the high permeability are clinker layers associated with a' a, lava tubes in pahoehoe, irregular openings between and within the flows, and contraction joints. Because most of the features that contribute to permeability lie parallel to flow surfaces, the stack of tabular units may be several orders of magnitude less conductive vertically than horizontally. Vesicles, which make up a large part of the total volume of the lavas and contribute greatly to the porosity, are seldom interconnected and have little effect on permeability. Connected porosity (through which water may flow) is believed to be generally less than 10%.

The Pearl Harbor Basal Water Body, comprised of lava flows associated with the Koolau and Waianae rift zones, serves as a primary source of potable and irrigation water for Honolulu and the island. Lavas of the Waianae and Koolau volcanoes comprise separate sections, or hydrologic units, of the Pearl Harbor Basal Aquifer, informally termed the Waianae aquifer (or Ewa-Kunia Aquifer System) and Koolau aquifer (or Waiawa – Waipahu Aquifer System). The presence of these separate areas has been inferred by observed head drops across the erosional unconformity between the two lavas, and differing water level trend patterns in wells installed in the two lavas. The differences have been attributed to the presence of a partial groundwater barrier along the contact between the Waianae and Koolau lavas. The barrier is comprised of a weathered zone and accumulations of alluvium, separating the lower, older Waianae lavas from the younger Koolau lavas. Head drop across the unconformity is about 2 to 3 feet with heads in the Koolau being higher. Therefore, flow across the contact is always from the Koolau to the Waianae sections. This flow is the major source of recharge to the Waianae aquifer.

The KVA is located overtop the Pearl Harbor Basal Water Body near the contact between the Waianae and Koolau aquifer portions of the basal aquifer. The contact between the Koolau and Waianae basalts is generally mapped as lying along the exposed surface contact of the two units. This contact is approximately 4,000 feet west of the Kunia Well site. Since the Waianae basalts dip from 5 to 10 degrees to the east, the effective separation lies further to the east. At a dip of 10 degrees, the sea level contact (approximately the water table surface) is over 1 mile to the east of the surface contact. At a dip of 5 degrees, the sea level contact is even further to the east. This indicates the Kunia Well is constructed in the Waianae aquifer. This conclusion is supported by an analysis of hydraulic gradient data between the Kunia Well/Basal Well and existing monitoring wells known to be completed in the Waianae and Koolau aquifers.

5.3.1 Conceptual Hydrogeologic Model

Based on analysis of the geologic and hydrogeologic data collected during the RI, the following conceptual hydrogeologic model has been developed to describe groundwater flow at the KVA:

- Surficial soil and saprolite occur to depths of approximately 80 to 100 feet and are underlain by approximately 100 feet of unsaturated, weathered basalt prior to the occurrence of unweathered basalt at 200 feet depth. A near-surface perched aquifer is confined to the saprolite material above the weathered basalt;

- Surface soil and saprolites are of relatively low permeability, with horizontal hydraulic conductivity on the order of 0.01 to 1 feet/day and vertical hydraulic conductivity about one order of magnitude less. Surface water runoff from the KVA is concentrated in the pit area due to local topography.

Low hydraulic conductivity of the surface soil and saprolites combined with surface water flow patterns creates locally saturated (perched) conditions in the saprolite in the pit vicinity;

- Horizontal flow in the perched aquifer occurs to the north-northeast. The extent of the perched aquifer is limited however to the general area south of the ephemeral gulch. North of the gulch the saprolites are unsaturated. Flow from the perched aquifer is primarily vertically downward due to the higher permeability of the underlying basalt. Evidence of this downward flow is the high downward gradients (on the order of 0.5 to 1) in the saprolite and absence of saturated conditions in the saprolite north of the gulch area. There are no surface seeps of perched aquifer groundwater or points of perched groundwater discharge to surface water (other than overflow from the pit resulting from extremely high precipitation);

- During the RI, the water table surface of the perched aquifer in the KVA was encountered at depths between about 0 feet (during rainy periods) near the edge of the pit to over 40 feet bgs, depending on location and season. Heads in the perched aquifer vary seasonally on the basis of rainfall. During dry periods the water table surface is lower than the bottom of the pit. Between April 1997 and July 1998 for instance, groundwater heads generally declined from about 10 to 20 feet in the perched aquifer at most locations in the KVA due to low rainfall;

- Downward migration occurs from the perched aquifer through the unsaturated basalts to the water table. Immediately beneath the saprolite perched aquifer, approximately 100 feet of weathered unsaturated basalt is present above unweathered basalt. The weathered basalt consists of a transitional zone between the saprolite and unweathered basalt with hydraulic properties intermediate between the two materials. Hydrologic data collected during perched aquifer drilling indicate the weathered basalt zone is unsaturated. Hydraulically, it is therefore an element of the unsaturated basalt sequence, which extends from the base of the saprolite to the water table surface;

- The saturated basalt is highly permeable, with groundwater flow at a gradient of about 1 to 1.5 feet/mile. Hydraulic conductivity is on the order of about 2,000 feet/day. Effective porosity of the basalts is about 0.05 to 0.10. The best estimate of average groundwater flow velocity in the saturated basalt is on the order of about 1,000 to 1,500 feet/year or about 3 to 4 feet/day;

- A variety of hydrogeologic data, consisting of KVA stratigraphic information, the projected extension of the Waianae surface exposure, and regional water level data, indicate that the basal aquifer beneath the KVA occurs within the basalts of the Waianae volcanic series. The direction of groundwater flow in this Ewa-Kunia Aquifer System is to the south-southwest;

- Within the basal aquifer, flow across the Waianae/Koolau unconformity is from the Koolau to the Waianae due to higher hydraulic heads in the Koolau. Therefore, the Waianae does not discharge to the Koolau. Because impacts from infiltrating perched groundwater are limited to the Waianae aquifer (or Ewa–Kunia Aquifer System), all potential downgradient receptors are therefore located within the Waianae aquifer only. Discharge of the Waianae aquifer would be to downgradient wells, and via leakage through the coastal caprock; and,

- The Hawaii Country Club (HCC) well is the nearest well potentially downgradient of the KVA. Hydrogeologic data are not definitive as to which aquifer the well is constructed within. However, the best professional judgment is that the well is completed in the Waianae aquifer, but due to proximity, is likely to be influenced by the Koolau aquifer (or Waiawa – Waipahu Aquifer System). The estimated travel time to the HCC well from the KVA is about 5 years or less. Other downgradient wells in the Waianae aquifer include the Board of Water Supply (BWS) Honouliuli I and II wells, and the US Navy's Barber's Point Shaft. All existing wells to the east of the Honouliuli wells, including the Kunia I/II wells, are constructed in the Koolau aquifer.

5.4 Summary of RI Data Collection Activities

The overall goal of the RI field sampling activities was to estimate the nature and extent of impacts from COPCs at known and suspected source areas, and to characterize the chemicals present in sufficient detail to prepare a BRA and FS. Data required to support these goals include information on geology, hydrogeology, soils, surface water and sediments, and the nature and extent of chemicals throughout pertinent environmental media.

The RI/FS Work Plan prepared by EPA identified the following "known" sources (where chemicals have been observed) which are collectively referred to as the KVA:

- Kunia Well Spill Area;
- Former Fumigant Storage Area, and
- Former Fumigant Mixing Area.

Additionally, suspected sources of potentially hazardous chemicals (Other Potential Source Areas) were selected by EPA based upon a review of historical activities at the Oahu Plantation. Releases of potential hazardous chemicals were not known to have occurred at these areas. The other potential source areas investigated during the RI include (see Figure 12 for locations):

- Perimeter Areas of the Former Fumigant Storage and Mixing Areas in the KVA;
- Former Fumigant Storage Area near Field 32;
- Empty Former Fumigant Drum Burial sites;
- Former Underground Storage Tank (UST) sites;
- Methyl Bromide Cylinder Burial Site in Field 71, and
- Current Soil Fumigant Storage Facility.

Although not identified as an Other Potential Source Area in the RI/FS Work Plan, the Excavation Pit Soils Natural Attenuation Area in Field 8 was also investigated during the RI at the request of EPA. Subsequent to the RI, two newly identified Other Potential Source Areas were sampled; the Rag Disposal Area near Field 202A and the Former Fumigant Mixing Area near the Karsten Warehouse in the Poamoho Section (see Figure 12 for locations of all three of these areas).

These known and suspected source areas were investigated under the following media-specific groupings:

- **Soils.** Includes surface and vadose zone soils in the KVA, as well as soils associated with the Other Potential Source Areas;

- **Surface Water and Sediment.** Surface water and sediments are associated with the ephemeral stream gulch northeast of the KVA, the smaller ravine southeast of the KVA, and the associated run-off pathways, and

- **Groundwater**. Consists of the perched groundwater zone and basal aquifer in the KVA and downgradient plume.

5.4.1 Kunia Village Area Soil Sampling

A total of 45 boreholes were drilled and sampled throughout the KVA. A total of 159 soil samples were collected from the 45 boreholes. Soil samples in the near-surface zone were collected at depths of 0.5, 2, and 5 feet below ground surface (bgs). For subsurface soils above the perched water table (vadose zone soils), samples were collected at additional depths of 10, 15, and 25 feet or until the perched aquifer was intercepted. Soil samples in the Former Fumigant Mixing Area were collected at depths of 1 and 3 feet bgs.

Additional soil samples were collected from nine boreholes drilled in the Former Fumigant Storage Area of the KVA. The nine boreholes were drilled to further characterize the extent of COPCs detected in deeper soils (i.e., below 30 ft depth) during drilling of monitoring wells MW-3 and MW-3S. A total of 42 samples were collected from the 9 boreholes. Soil samples were collected at ten-foot depth intervals from each borehole starting at a depth of 25 to 30 feet bgs and continuing until encountering weathered basalt or auger refusal. The sampling frequency was increased to every five feet in areas where potentially higher concentrations of COPCs were anticipated. Following completion of the RI, two additional boreholes were drilled and sampled in this area to further refine the distribution of contamination and assist with locating extraction wells installed for the phytoremediation treatability study. Also, a total of 40 soil samples were collected from 18 boreholes in the Former Fumigant Storage and Mixing Areas during installation of perched groundwater extraction wells in support of the phytoremediation treatability study.

Additional data are needed to the southeast of Extraction Well 32 and to the south of Monitoring Well 16 to delineate the extent of soil contamination exceeding residential soil preliminary remediation goals. Sampling to eliminate this data gap will be conducted during remedial design.

To evaluate chemical concentrations present in the soil air space, soil vapor sampling was conducted at a depth of 11 feet bgs in two boreholes located in the Former Fumigant Storage Area and two boreholes in the Kunia Well Spill Area. EPA also collected two soil vapor samples in November 1997. One sample was collected in the Kunia Spill Area and the other was collected in the Former Fumigant Storage Area.

5.4.2 Kunia Village Area Surface Water and Sediment Sampling

Surface water and sediment sampling was conducted in the ephemeral gulch northeast of the KVA that eventually drains into the Poliwai Gulch, and the smaller ravine just to the southeast of the KVA. The focus of the surface water and sediment investigation was to determine if COPCs in stormwater runoff and eroded soils are present in the ravine and gulch sediment/soil or surface water at concentrations that pose an unacceptable risk to human health.

Sampling included the collection of five sediment samples along the northeast ephemeral gulch, three soil samples within the ravine southeast of the Kunia Spill Area, and two surface/near surface sampling locations in areas downgradient of both the Kunia Well Spill Area and the Former Fumigant Storage

Area. Surface water samples were collected from three locations along the flowpath of the ephemeral gulch northeast of the Former Fumigant Mixing and Former Fumigant Storage Areas during a period of heavy sustained rainfall. One surface water sample was also collected from the excavation pit water contained within the fenced area of the Former Fumigant Mixing Area.

5.4.3 Kunia Village Area Perched Groundwater

EDB, DCP and DBCP have historically been detected above their respective maximum contaminant levels (MCLs) in the perched water-bearing zone in the vicinity of the KVA. The primary concern related to the residual COPCs is whether they pose an unacceptable risk to human health via transport to either surface water via seeps or springs, or transport to the basal groundwater by migration through the unsaturated basalt or through the Kunia Well annulus, or from potential surfacing of perched groundwater in the area.

Data collected to address these issues for the perched zone aquifer included measurements of COPC concentrations to assess the lateral and vertical distribution of chemicals in the perched water-bearing zone and measurements needed to assess the hydraulic characteristics and hydrogeology of the perched water-bearing zone including permeability, groundwater flow direction and gradient.

The following methods of data collection were used:

- Piezometer Installation - Eight 1-inch diameter piezometers were installed in the upper portions of the perched water-bearing zone within the KVA. Data collected from the piezometers were used to define the boundaries of the perched water-bearing zone, hydraulic properties of the perched groundwater system, and the lateral extent of contaminants.

- Perched Groundwater Monitoring Well Installation - Three perched zone monitoring wells (MW-1, MW-2, and MW-3) were installed in the KVA during an initial phase of field work. Data collected from the three initial perched zone monitoring wells combined with data collected from the eight piezometers were evaluated and used to design the second phase of field investigation activities.

  The second phase of field investigation included the installation of three additional monitoring wells to further define the lateral migration of COPCs in the perched groundwater system.

- In addition to the perched monitoring wells installed as part of the RI, a series of 35 12-inch diameter perched aquifer extraction wells and 14 4-inch diameter monitoring wells were installed after the RI in and adjacent to the Former Fumigant Storage Area and the Former Fumigant Mixing Area in support of the Pilot-Scale Phytoremediation Treatability Study. The locations of all the perched zone monitoring and extraction wells (EW series wells) installed to date are shown in Figure 6.

- Perched Groundwater Monitoring Well Sampling Program - In addition to the perched groundwater sampling conducted during monitoring well drilling and well installation, a quarterly groundwater sampling program was established for the six perched groundwater monitoring wells (MW-1, MW-2, MW-3, MW-3S, MW-5, and MW-6). Locations of piezometers and perched zone monitoring wells are shown in Figure 6.

- Perched Groundwater Sampling - Perched groundwater samples were collected from EW series wells during eight different sampling events between June 1998 and June 2001. Because of low perched water levels and de-watering of the Former Fumigant Storage Area through perched groundwater extraction, many of the EW series wells did not contain sufficient water for sampling during some or all of the sampling events.

5.4.4 Basal Aquifer Investigation

The first step of the basal aquifer investigation was to conduct a series of activities, termed “vertical profiling” to evaluate the vertical distribution of chemicals within the Kunia Well, the possibility of chemical migration through the well’s annulus from the perched groundwater aquifer to the basal aquifer, and the suitability of the Kunia Well for use as a monitoring well. Based on the results of the profiling activity, the well was deemed suitable for use as a monitoring well and for aquifer testing.

The basal aquifer investigation proceeded with the following field investigative items:

- Drilling and installation of a 993.5-ft deep, 8-inch diameter downgradient Basal Well, located 156 ft south of the Kunia Well;
- Performance of a two-well pumping test using the Kunia Well as the pumping well, and the new downgradient Basal Well as the observation well, to assess site specific hydraulic properties and obtain additional chemical data;
- A program of periodic basal well sampling, involving the Kunia Well and new downgradient Basal Well. This monitoring program extended beyond the completion of the RI.
- Sampling of regional basal groundwater supply or monitoring wells including the ”Navy Well,” the Hawaii Country Club Well, a well at the US Air Force’s Waikakalaua Fuel Storage Annex (FSA) area (Well ST12MW05) (the Waikakalaua FSA well ST12MW05 was determined to be neither upgradient or downgradient of the KVA and as such was only sampled once.), and Honouliuli II Well No. 2303-03. The Honouliuli II well provides additional water quality data from a portion of the Ewa-Kunia Aquifer System that is potentially downgradient of the KVA.

To eliminate data gaps from the Remedial Investigation, additional site characterization will be conducted during Remedial Design to determine the nature and extent of contamination in the basal aquifer source area and the downgradient plume.

5.4.5 Other Potential Source Areas

The Other Potential Source Areas were selected by EPA based upon historical activities at the Oahu Plantation. The primary purpose for evaluation of these sites was to determine whether they pose potential human health and environmental risks that require further characterization. The following sampling approach was applied in the Other Potential Source Areas.

Perimeter Areas of the Kunia Village Area – EPA identified areas where empty drums appeared to have been stored around the perimeter of the KVA. One area is on the west side of the maintenance building; the second area is north of the Former Fumigant Storage Area. Four perimeter area soil samples were collected at a depth of five feet from these areas.

Former Fumigant Storage Area Near Field 32 – Between the early 1940’s and 1955, a soil fumigant cylinder and drum storage area was operated by Del Monte in a pineapple field area located near the current pineapple Field 32. The area encompasses approximately 90 feet by 110 feet.

Nine soil borings were installed in this area on a triangular grid with approximately 33-foot spacing between holes. Soil samples were collected from depths of 0.5, 2, 4, 10, 15, and 25 feet bgs.

<u>Empty Fumigant Drum Burial Sites</u> – In the past, empty soil fumigant drums were buried in agricultural areas on the Oahu Plantation. This was done as specified on the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) product labels. Five of the 22 identified empty drum burial sites were selected for investigation. The sampling sites were chosen based upon accessibility, geographic distribution, and to sample the potentially worst case scenario in Field 60 where 8 of the 22 sites are located. The five sampling sites selected for investigation include:

- Empty Drum Burial Site behind the Poamoho Crateyard;
- Empty Drum Burial Site in Field F-90A (previously designated as Field 94);
- Empty Drum Burial Site in Field F-60;
- Empty Drum Burial Site in Field F-31, and
- Empty Drum Burial Site in Field F-32.

Geophysical equipment was used to delineate the boundaries of the five empty drum burial sites. Three boreholes were drilled at each empty drum burial site in the area identified by the geophysical surveys to have the highest potential to contain buried material.

Physical evidence locating an empty drum burial site was not obtained at two of the initial sites investigated (Fields F-31 and F-32). Two additional empty drum burial sites were identified and sampled in Field F-60, where 8 of the 22 total buried drum sites are located. Additional geophysical surveys were performed at the two sites. The geophysical surveys successfully determined the location of the two additional empty drum burial sites in Field F-60.

<u>Former Underground Storage Tank (UST) Sites</u> – Three former UST sites were investigated as part of the RI (the Poamoho Crateyard, Maintenance Building Dip Pan, and Field 9 Booster Pump former USTs). The field investigations of the permanently closed USTs included collection of soil samples in areas between or adjacent to the former USTs or associated piping where petroleum releases may have occurred. The former UST sites had been permanently closed by removal prior to the HDOH requirements for submittal of closure reports implemented in 1987. The RI sampling was designed to supplement previous sampling at the sites and document UST closure.

<u>Methyl Bromide Cylinder Burial Site in Field 71</u> – A buried metal cylinder containing approximately 43.5 pounds of methyl bromide was reportedly buried in Field 71. Geophysical survey equipment was used in an attempt to locate the precise location of the buried cylinder. Although no definitive burial area was located using the geophysical survey, backhoe exploratory pits were excavated in the areas where two minor magnetic anomalies were identified. A third pit was dug in the area based upon historical data. The excavated soil and the excavation pits were inspected for any indication of buried debris. No indications of the buried methyl bromide cylinder were identified in any of the excavation pits; therefore, no soil samples were collected for chemical analysis.

<u>Current Soil Fumigant Storage Facility</u> – The Current Soil Fumigant Storage Facility, a concrete-lined above ground product storage facility, was visually inspected by EPA during a site tour on April 29, 1997. No sampling was performed during the RI because there was no evidence that a release had

occurred. The facility contains two 5,000-gallon stainless steel product storage tanks. Both tanks are contained in a covered concrete lined containment area and can be visually inspected for cracks, leaks, or spills. Dispensing hoses are equipped with vapor return lines.

Excavation Pit Soils Natural Attenuation Area in Field 8 – As described above, the previous remedial actions included removal of approximately 18,000 tons of soils from the spill area, the former mixing area, and the former storage area during 1981 and 1983. The excavated soils were spread in a thin layer over a fallow pineapple field area encompassing approximately 20 acres in Field 8 located approximately 1,700 feet west of the Kunia Village Area. The excavation and natural attenuation activities were approved by the State of Hawaii because the soil fumigants were still registered for agricultural uses at the time.

Excavation was conducted with a backhoe and bucket excavator. The excavated soils were trucked directly to the soil spreading area. After spreading, approximately 20 tons of cow manure were spread onto the field area followed by harrowing to breakup the saprolite/soils. Since the 1980s, four pineapple crops have been grown in the Natural Attenuation Area in Field 8.

During initial project scoping, EPA determined that it was not necessary to conduct environmental sampling at the field 8 area. However, in response to community concerns, EPA and Del Monte decided to conduct environmental sampling in the area. The sampling program was designed to determine if any residual contaminants remained in soil at levels that pose risks to human health or the environment. The investigation included collection of soil samples from the approximate depths of 2, 10, and 15 feet in each of nine borehole locations distributed evenly throughout the natural attenuation area.

Former Fumigant Mixing Area Near Karsten Warehouse – During the late 1950s and early 1970s, a fumigant mixing area near the Karsten Warehouse was used for diluting concentrated soil fumigants with diesel fuel. The soil fumigants included EDB and possibly Shell DD (a mixture of 1,2-dichloropropane, 1,3-dichloropropene, 2,3-dichloropropene, 3,3-dichloropropene and traces of trichloropropane). During the mixing operations, spills occasionally occurred. Rags used to wipe down the fumigant drums were discarded in the Rag Disposal Area discussed in the next section.

In September and October 2002, soil samples were collected within the 30 by 40 foot boundary of the Former Fumigant Mixing Area and analyzed for VOCs. The only compound detected at a concentration greater than residential preliminary remediation goals (PRGs) was 1,2,3-TCP at 10 micrograms per kilogram (µg/kg) at a depth of 15 feet bgs. EPA's residential PRG for TCP is 5 µg/Kg.

Additional sampling at depths below 15 feet bgs was conducted in February 2003 to determine the extent of TCP contamination. The second round of sampling showed TCP at levels below the residential PRG with the highest level being 4.4 µg/Kg.

Rag Disposal Area Near Field 202A – The rags used in the Former Fumigant Mixing Area Near Karsten Warehouse were discarded in a debris disposal and burn area operated by the City and County of Honolulu. Sampling in this area was conducted in September and October 2002. The sampling at the Rag Disposal Area differed from sampling at the Former Fumigant Mixing Area because the depth of the debris was unknown and the most critical samples would be the soil samples beneath the disposal area.

Core samples were collected within the burn debris to a depth of approximately 3-5 feet beneath the bottom of the debris for visual observation and field screening for the potential presence of chemicals. Test pits identified the boundaries of the refuse disposal and burn site as an oblong area approximately

100 feet wide by 130 feet long. The nineteen samples were analyzed for VOCs, TPH-diesel Lindane, Toxaphene and Heptachlor.

No compounds were detected at concentrations above EPA's residential PRGs. Three of the 19 soil samples contained detected compounds: 1) benzene at 4.2 µg/Kg, which is less than the PRG of 600 µg/Kg; 2) bromomethane at 7.5 µg/Kg, which is significantly less than the PRG of 3,900 µg/Kg; and 3) toluene at 5.2 µg/Kg, which has a PRG of 520,000 µg/Kg.

5.5 Nature and Extent of Contamination

The following is a summary of chemical compounds detected above regulatory screening criteria in each of the study areas investigated as part of the RI. All four COCs (EDB, DBCP, DCP, and TCP) are classified as probable (B2) human carcinogens.

KVA Soil Samples – There were no COPCs detected in vadose zone soil samples above the EPA Region IX residential PRGs. (EPA's PRGs are developed based on potential human health impacts and are commonly used as screening-level values for comparison to site-specific concentrations detected during RI activities.) EDB, DBCP, and other VOCs were not detected in KVA shallow vadose zone soils, with the exception of three samples in the former excavation pit where EDB was detected at an estimated concentration of 0.37J to 0.38J µg/kg (see Table 1). One soil sample at borehole number 1 contained total petroleum hydrocarbon (TPH) compounds in excess of Hawaii regulatory standards. Del Monte, in consultation with the HDOH, excavated the TPH impacted soils, collected confirmatory samples from the excavation pit, and treated the excavated soils by thermal desorption in compliance with applicable regulations. The cleanup activities for petroleum constituents were documented in a Petroleum Release Report prepared by Del Monte and submitted to the State of Hawaii and EPA. Soil gas samples collected in the vadose zone did not contain concentrations of contaminants that would cause a risk.

Additional Soil Samples in the Former Fumigant Storage Area – Additional soil samples were collected as part of Treatability Investigation Site Characterization activities. Results are presented in Tables 2a and 2b. The primary purpose of the Treatability Investigation Site Characterization data was to provide additional chemical data to optimize placement of a series of perched extraction wells needed for implementation of the Phytoremediation Treatability Investigation. Several samples collected from soils at depths of 25 feet and deeper within the Former Fumigant Mixing Area had detected concentrations of EDB, DBCP, and DCP. The highest compound concentrations were typically detected at the base of the perched groundwater system. One exception to this is elevated levels of DBCP and DCP detected at depths of 30 to 40 feet in two boreholes located in the northeastern portion of the Former Fumigant Storage Area. None of the detected concentrations indicate presence of dense nonaqueous phase liquid (DNAPL).

KVA Surface Water – Three surface water samples were collected along the flowpath of the ephemeral gulch north of the Former Fumigant Mixing and Storage Areas. Water only flows in the gulch during heavy rainfall, and samples were collected during an unusually heavy rainfall event. EDB and DBCP were detected in one of the samples at concentrations of 170 µg/L and 0.4 µg/L, respectively. A grab sample from the excavation pit collected at approximately the same time contained similar concentrations of EDB and DBCP (167 and 0.3 µg/L, respectively). During the time when the surface water samples were collected (March 1997), water within the excavation pit had risen to a historically high level due to the record rainfall during the winter of 1996-97, and appears to have been flowing into the ephemeral gulch at a point where the surface water sample that exhibited the EDB/DBCP detections was collected. Because the samples both contained similar concentrations of EDB and DBCP the detections are believed to be the result of water from the excavation pit overflowing into the gulch. The other two samples collected in the ephemeral gulch did not contain detectable levels of EDB and DBCP. Bromacil and lindane were also observed in surface water samples, but at concentrations below MCLs or PRGs. With EPA's approval, Del Monte constructed an earthen berm to prevent potential future stormwater runoff from the excavation pit as an interim measure during completion of the RI/FS. Additional stormwater runoff samples were collected during October 1999. EDB and DBCP were not detected in these samples.

The pit filled on a seasonal basis, but did not contain water every year. Del Monte personnel have stated that rain water collected in the pit during just 3 of the 10 years before it was backfilled in October 1999. As a result of the backfilling, surface water no longer collects in the area.

<u>KVA Perched Groundwater</u> – Samples collected from portions of the perched groundwater system beneath the KVA indicated the presence of EDB, DBCP, DCP, TCP, benzene, and lindane in excess of MCLs or PRGs. A summary of results for all perched zone monitoring wells and extraction wells for EDB, DBCP and DCP is presented in Table 3. The concentrations of these compounds are generally lowest in the Kunia Well Spill Area and the Former Fumigant Mixing Area. The highest detected concentrations during the RI were generally detected in the Former Fumigant Storage Area in the vicinity of wells MW-3 and MW-3S. The large number of extraction and monitoring wells installed after the RI as part of the phytoremediation treatability study indicate additional areas with high concentrations, including areas northeast of the Former Fumigant Storage Area and areas to the southwest in the vicinity of the 1977 EDB spill (Figures 7, 8 and 9). The results of the RI and subsequent Treatability Study work indicate that chemical impacts to perched groundwater are limited to an area roughly 400 ft by 400 ft at the Kunia Village Area.

Hydropunch and monitoring well sampling of the perched groundwater system, as well as soil sampling results, indicates that contaminant concentrations are generally highest at the base of the perched groundwater system. One exception to this is the area around MW-3S, TB-4, TB-5, and TB-6 (center of the Former Fumigant Storage Area) where concentrations of DBCP and DCP are generally highest at a depth of 30 to 40 feet. Outside of the MW-3S area contaminant concentrations were generally present only below 50 feet.

<u>Basal Aquifer Sampling Results</u> – The presence of COPCs in the basal aquifer beneath the KVA was investigated through the collection of groundwater samples from the Kunia Well and the new Basal Well (State Well No. 2703-02). Multiple samples have been collected from both wells and tested for the full list of preliminary COPCs evaluated during the RI/FS. Results are presented in Table 4. EDB, DBCP, and TCP are the only compounds, that have been detected in either well above HDOH drinking water MCLs. The concentrations of EDB detected in the Kunia Well ranged from less than the detection limit to 0.22 µg/L. DBCP ranged from 0.64 to 1.4 µg/L. The concentrations of EDB and DBCP detected in the Basal Well ranged from 0.1 to 0.26 µg/L and 0.66 to 0.93 µg/L, respectively. The Hawaii drinking water standard for EDB and DBCP is 0.04 µg/L. The concentrations of TCP ranged from non-detected to 1.0 µg/L in the Kunia Well and non-detected to 0.8 µg/L in the Basal Well. The Hawaii drinking water standard for TCP is 0.6 µg/L. During the RI, it was determined that the Kunia Well annulus does not currently constitute a significant conduit for migration of constituents into the basal aquifer.

Regional basal wells were also included in the groundwater sampling program: the "Navy Well," HCC Well, Well ST12MW05 at the Air Force Waikakalaua FSA, and Honouliuli II Well 2303-03. Results are presented in Table 5 and are summarized below. Table 6 presents results from regional basal well sampling conducted by the HDOH.

- The Navy Well is an upgradient well located approximately 1 mile north of the KVA. The well is completed within a transitional zone between the Schofield High-level Water Body and the Pearl Harbor Basal Aquifer. TCE was detected in the Navy Well at a maximum concentration of 3.0 µg/L.
- The HCC well, located approximately 1.5 miles south of the KVA, is the nearest potentially downgradient well. While there is some uncertainty as to which aquifer the well is completed in, the best professional judgment is that the well is completed in the Waianae aquifer. However, even if the well is within the same aquifer as the Kunia Well/Basal Well, it may not be located on the downgradient flowpath from the KVA. EDB was detected in two rounds of sampling at concentrations of 0.025 and 0.019J µg/L. DBCP was detected at concentrations ranging from less than the detection limit (0.02 µg/L) to 0.071 µg/L. DCP and TCP were detected only during the Jul-98 sampling round below the laboratory's practical quantitation limits at estimated concentrations of 0.14 and 0.22 µg/L, respectively. The drinking water standards for DCP and TCP are 5.0 and 0.6 µg/L, respectively.
- TCE was detected at a concentration of 0.5 µg/L in well ST12MW05. The Air Force well is located approximately 1.5 miles east of the KVA and is completed within the Koolau portion of the Pearl Harbor aquifer.
- There were no compounds detected in the Honouliuli II Well during the May-98 and Jul-98 sampling rounds.

<u>Other Potential Source Areas</u> – Other Potential Source Areas identified in the RI/FS Work Plan (ICF 1997), two additional empty drum burial sites, and the Natural Attenuation Area in Field 8 were investigated as part of the RI. The Rag Disposal Area Near Field 202A and the Former Fumigant Mixing Area Near the Karsten Warehouse were investigated subsequent to the RI. With one exception, no COPCs were identified at any of the Other Potential Source Areas above residential PRGs or Hawaii action levels for TPH. The one exception is the presence of TPH-diesel compounds detected near a former underground storage tank located at the Field 9 Booster Pump site. Soil samples collected at depths of 16 ft and 25 ft bgs had detected TPH concentrations in excess of the State of Hawaii Tier 1 Action Levels. In September 1998, Del Monte, in consultation with the State of Hawaii, excavated the petroleum impacted soil, conducted confirmation sampling, and treated the impacted soils by thermal desorption at a State approved facility. The cleanup activities for petroleum constituents were documented in a Petroleum Release Report submitted to the State of Hawaii and EPA.

Based on the results of the RI, no further response actions are necessary at the Other Potential Source Areas.

5.6 Contaminant Fate and Transport

Fate and transport analysis was conducted to estimate exposure point concentrations for the relevant exposure pathways. The primary aims of this analysis were as follows:

- Identification of the relevant contaminant exposure pathways. An exposure pathway describes the processes that link a chemical source to a potential receptor.

- Assessment of the environmental fate of COPCs along these pathways to describe the behavior of each COPC in the environmental media in which it is transported, and

- Estimation of the resulting exposure point concentrations of COPCs to potential pathway receptors.

The potential exposure pathways considered included: 1) direct exposure to COPCs in site soils; 2) airborne exposure to COPCs in on-site soils; 3) exposure to COPCs in surface water; and 4) exposure to COPCs via groundwater. There is currently no significant shallow soil or soil gas contamination present in the KVA, so exposure pathways 1 and 2 are not considered important pathways. Because the excavation pit has been filled in, there is no longer the potential for exposure to contaminated surface water in the KVA, eliminating pathway 3. There are no direct exposure pathways to the perched aquifer as it is not a drinking water source and it does not pose a significant risk from volatilization and inhalation exposure to COPCs. The only exposure pathways warranting detailed contaminant fate and transport evaluation are related to basal groundwater. Thus, the focus of the transport analysis was on the basal aquifer. The primary aim of the fate and transport evaluation was to estimate the potential receptor point concentrations in the basal aquifer that may occur from the KVA basal groundwater impacts.

Understanding the interaction between the perched and basal aquifers was an important element of the basal aquifer fate and transport modeling. This understanding is based on the recognition that levels of chemicals in the perched and basal aquifers have been declining for nearly 20 years. These declines have been due at least in part to the source removal activities which occurred in the early 1980s, and pumping from perched groundwater extraction wells and the Kunia Well through the early 1990s. Due to the source removal work and attendant concentration reductions, levels of chemicals in the basal groundwater are not expected to increase in the future. Therefore, the prediction of future impacts to downgradient basal aquifer water quality can be conservatively made using current concentrations.

The general approach to the contaminant transport model, BIOSCREEN, was to assess the potential downgradient extent of COPC migration from the KVA in the Waianae aquifer. Modeling was conducted for the following two sets of analyses:

- Modeling of the present day downgradient impacts due to historical (1980 through 1997) COPC occurrences in basal groundwater (conducted for EDB and DBCP only); and

- Modeling of future impacts (present to future) due to the currently observed KVA concentrations (conducted for EDB, DBCP, TCP, and DCP).

The primary results and conclusions of the fate and transport analysis are summarized below.

- The only significant current source of chemicals to the basal aquifer is area wide infiltration of perched aquifer groundwater in the immediate vicinity of the KVA. The Kunia Well, while it may have served as a conduit for COPCs in the past, does not currently represent a significant conduit for vertical migration of chemicals to the basal aquifer and has not since about 1990. Even during the time period when the well may have served as a conduit, pumping of the well was sufficient to contain chemicals, which reached the basal aquifer via this mechanism. Therefore, fate and transport modeling considered the impacts from KVA-area wide infiltration and not leakage through the Kunia Well annulus. The areal extent of the perched aquifer contaminant source to the basal aquifer can be approximated by the area exceeding 1 μg/L on Figures 8 and 9.

- Based on capture zone analysis, pumping of the Kunia Well prior to its disconnection from the potable water supply in April 1980 is believed sufficient to have contained basal aquifer COPCs and prevented migration away from the KVA. Pumping between 1980 and 1994 may have been sufficient to limit, perhaps significantly so, downgradient migration; however, it has been conservatively assumed in the RI that pumping after 1980 was not sufficient for containment. Transport modeling of impacts from historical COPC occurrences is therefore conducted for basal groundwater impacts that occurred after April 1980.

- Contaminant transport modeling was conducted for EDB and DBCP for the historical modeling runs, and for EDB, DBCP, TCP, and DCP for the predictions of future migration. These four compounds are the only compounds consistently detected in the basal aquifer at the KVA. Historical data are not adequate to model prior occurrence of TCP and DCP.

- The thickness of basal groundwater impacted by chemicals infiltrating from the perched groundwater is estimated to be small in relation to the screened interval of the Kunia Well. A conservative estimate suggests that it does not exceed a thickness of about 1 to 10 feet near the water table surface directly beneath the perched aquifer source area.

- The Kunia Well is located within the source area of COPCs in the basal aquifer, or is extremely close to it, and capture zone analyses predict that the well draws water primarily from the source area during sampling events. Chemical data obtained from the well can therefore be used to estimate source area concentrations for subsequent transport modeling. Because the well likely draws water from most of the 150-foot screened interval, and chemicals are believed restricted to the upper 1- to 10-feet, contaminant concentrations observed in the well during pumping need to be increased to reflect the levels considered representative of the surface impacted layer. The results of the vertical profiling are believed more representative of these levels than those measured during pumping. Estimates of EDB and DBCP impacts to the basal groundwater from perched groundwater generally support the view that vertical profiling results are representative of the near water table surface source layer. EDB and DBCP levels measured during vertical profiling were 5 to 10 times and 2 to 3 times higher than levels measured during pumping, respectively. For modeling potential impacts to basal groundwater quality, these factors were used to adjust historical Kunia Well data obtained during pumping to reflect the concentration in the thin, near surface impacted zone.

- Any potential receptors of chemicals migrating away from the KVA are associated with the Waianae basalts, as groundwater beneath the KVA is within the Ewa-Kunia Aquifer System of the Pearl Harbor basal Aquifer Sector. Waipahu Aquifer System wells, such as the Kunia I and II wells, are not at risk as they are hydraulically separated from the Ewa-Kunia Aquifer System by the higher heads of the Waipahu Aquifer System. The higher head is due to the greater recharge that occurs to the Waipahu Aquifer System and the discontinuity between the two aquifer systems, which acts as a barrier to water movement. Potential downgradient receptor points therefore include the HCC well, Honouliuli I and II wells, and possibly other Ewa-Kunia Aquifer System wells further beyond the Honouliuli wells, such as the Barber's Point Shaft. Though the wells are believed installed in the same aquifer as the Kunia Well/Basal Well, there is uncertainty whether these wells are located along the downgradient flowpath from the KVA.

- Although there is limited water quality data from the HCC Well prior to 1993, the first observed occurrence of DBCP was in 1993. Estimates of groundwater travel time from the KVA to the HCC well (about 5 years or less) indicate that DBCP should have been detected at the well earlier than

1993 if it was indeed derived from the KVA. But, if Kunia Well pumping after 1980 was more effective than assumed at containing DBCP, then the travel time of DBCP to the HCC well could have been delayed, and DBCP occurrences at the HCC well could still be attributable to the KVA. There are also other sources of DBCP in central Oahu that could account for the HCC well contamination. It is not certain that the HCC well is located on the downgradient flowpath from the KVA or is in the same aquifer. Hydraulic gradient data suggests the well is not on the flowpath from the KVA. Because of these uncertainties, it is not possible to determine whether the observed DBCP is associated with the KVA. If the DBCP at the HCC well is attributable to the KVA, it is unlikely that the concentrations will increase in the future because sufficient time has passed for the peak concentrations of a potential plume to have reached the well.

- For the Honouliuli II wells, travel time estimates indicate that KVA chemicals should have already reached the wells, if they were to do so, but no chemicals had been observed as of sampling conducted in December 1998.

- As illustrated in Figure 10, the modeling of historical impacts indicates that the furthest downgradient distance of EDB and DBCP in excess of MCLs, assuming a "reasonable worst case" scenario, is about 4,500 feet from the KVA for both compounds. Using more typical values for the various transport input parameters results in "average case" estimated travel distances of about 2,500 feet for EDB and 2,900 feet for DBCP. Therefore, under all scenarios, including the reasonable worst case scenario, the anticipated travel distances of EDB and DBCP in excess of MCLs are still within the Del Monte Oahu Plantation property boundaries under existing pineapple fields.

- Basal aquifer impacts may extend beyond these distances, for instance to the HCC well and possibly to the Honouliuli wells, but not likely at levels that are above drinking water standards. The model predicts, using the "reasonable average case" input parameters, current EDB and DBCP levels at the HCC well of approximately 0.01 to 0.02 µg/L (approximately equivalent to the method detection limits). This assumes the HCC well is located along the downgradient flow path from the KVA, which is not certain. Recent DBCP analytical results for the HCC well were 0.06 µg/L (April 1999) in sampling conducted by HDOH. EDB was less than the quantitation limit of 0.04 µg/L. If the observed DBCP at the HCC well is associated with the KVA, then the model used herein is matching the observed data reasonably well. The model predicts declines in DBCP concentrations in the vicinity of the HCC well in the future if the source area concentrations continue to decline.

- It is also possible that impacts above the detection limit, but below the MCL, may extend to the Honouliuli wells. Under the reasonable worst case scenario, EDB and DBCP levels should fall in the range of about 0.01 to 0.02 µg/L. Under the average case scenario, however, the estimated levels for both compounds should be less than 0.01 µg/L. As with the HCC well, it is not certain, however, if these wells are located on the downgradient flow path from the KVA. No COPCs have ever been detected at these wells, including sampling conducted through 1997.

- Modeling of future impacts from present-day concentrations (which conservatively assumes constant source area concentrations into the future) indicates that the estimated maximum future travel distance from the KVA to a downgradient MCL exceedance is about 3,000 feet for DBCP (Figure 11). The maximum travel distance of groundwater exceeding the EDB MCL is estimated to be approximately 2,000 feet. The estimated MCL exceedance travel distances using "average" parameters are about 1,300 and 2,000 feet for EDB and DBCP, respectively. Estimated travel distances for groundwater with DCP and TCP MCL exceedances are much shorter (less than about

100 ft). These estimated travel distances are much smaller than the EDB and DBCP travel distances because KVA DCP/TCP concentrations barely exceed MCLs.

- These modeling results indicate that there is little likelihood of future impacts to any existing downgradient well at levels above MCLs even if current concentrations remain constant in the KVA. In addition, the anticipated future travel distances to the EDB and DBCP MCLs are still within the Del Monte plantation's property boundaries under existing pineapple fields.

- The estimates of travel distances are based upon conservative assumptions and calculations, including reasonable worst case scenarios and, therefore, likely overestimate actual conditions. For instance, the modeling is based on a water table surface concentration, which ignores typical well construction practices on Oahu where wells are screened over large intervals. Also, no downward gradients or dilution due to infiltrating rain water were assumed. In addition, only a relatively small amount of containment (25%) was assumed from pumping during the period 1980 to 1994, based on the minimum pumping rate over the period (4 hours per day twice per week at 325 gpm). During the early 1980s, when levels of COPCs were highest in the Kunia Well, pumping was considerably greater than the minimum. The actual pumping rate varied from a minimum of 8 hours per day twice per week to more frequent and sometimes continuous operation. If a greater amount of containment was occurring than was assumed in the model, then the estimated travel distances and downgradient concentrations (historically observed impacts) would be lower than those presented herein.

Actual travel distances will be determined by data collected from groundwater monitoring wells to be installed during design.

6 Current and Potential Future Site and Resource Uses

6.1 Land Uses

The Del Monte Oahu Plantation is a 6,000 acre pineapple plantation located approximately 15 miles from Honolulu. The closest town is Wahiawa, which is located approximately 2 miles from the KVA. The Kunia Section of the Site extends to the southern boundary of Schofield Army Barracks and Wheeler Military Airfield and the Poamoho Section of the Site is north of the Schofield Army Barracks and Wheeler Military Airfield.

The Oahu Plantation facility is an active agricultural operation currently managed by Del Monte. While comprised primarily of agricultural areas, the facility also contains two company operated housing complexes (Kunia Village and Poamoho Village), equipment maintenance areas, chemical storage areas, warehouses, and administrative buildings. A fresh pineapple packing facility is located within the property boundaries. The Kunia Village housing complex is in close proximity to the primary source areas located around the Kunia Village well and the surrounding historical chemical storage and handling areas.

The United States Army plans to purchase a portion of the agricultural lands in the northern part of the Kunia Section in order to develop the area as a target range and medium weight vehicle training area.

EPA plans to propose a Partial Site Deletion to remove the Poamoho Section from the Site. The Partial Site Deletion will be published in the Federal Register following a public comment period.

Aside from the planned United States Army acquisition, it is anticipated that the lands encompassed by the Site will remain in agricultural use.

6.2 Groundwater Uses

The shallow, perched groundwater is not a current or potential future source of drinking water because it does not provide sufficient sustainable yield for use as a water supply. Therefore, no drinking water or irrigation production wells pump from the shallow, perched groundwater aquifer.

There are production wells in the deeper basal aquifer in both the KVA and in downgradient areas. The Kunia Village Well was formerly used for drinking water purposes, but was disconnected from the potable water supply system in April 1980 after contamination was discovered in the well. Between 1980 and 1994, the well was pumped periodically with the water discharged directly to non-crop fields.

It is expected that the Kunia Village Well may again be available for use as a source of drinking water after the perched and basal aquifer remedies are complete (including post-operation monitoring) and all contaminants in the basal aquifer are below drinking water standards. The estimated timeframe for remediation and post-operation monitoring is 10 to 15 years.

The drinking water for the KVA is presently supplied primarily by the “Navy Well” and occasionally, since 1991, by Del Monte Well No. 4. Both the “Navy Well” and Del Monte Well No. 4 are located approximately 1.5 miles north (upgradient) of Kunia Village. These two drinking water supply wells have been approved by the HDOH. A packed tower aeration facility (i.e., an air stripper) was installed in 1989 to remove volatile organic compounds possibly migrating in the high-level aquifer groundwater from the Schofield Army Barracks Superfund Site. The drinking water supply for the Kunia Village has been treated using the packed tower aeration facility since 1991.

The HCC well is the nearest basal well potentially downgradient of the KVA. Hydrogeologic data are not definitive as to which aquifer the well is constructed within. However, the best professional judgment is that the well is completed in the Waianae aquifer (which is the same aquifer as the Kunia Village Well). The estimated travel time from the KVA to the HCC well is about 5 years or less. The HCC well is currently treated for drinking water purposes. Drinking water for the golf course is supplied by Del Monte. from the potable water system that serves Kunia Village. Other downgradient wells in the Waianae aquifer include the Honouliuli BWS wells and the US Navy's Barber's Point Shaft.

In addition to being used for drinking water purposes, basal wells in the Waianae aquifer are pumped and used for irrigation purposes. Basal groundwater extracted and treated pursuant to the remedial action selected in this ROD will be used for irrigation of pineapple crops on the Site.

All existing wells to the east of the Honouliuli I wells, including the Kunia I/II wells, are constructed in the Koolau aquifer. Within the basal aquifer, water flows from the Koolau aquifer to the Waianae aquifer due to higher hydraulic heads in the Koolau. Water does not flow from the Waianae aquifer into the Koolau aquifer. Basal wells in the Koolau aquifer are used for both drinking water and irrigation purposes.

Future basal groundwater use in the area is expected to be similar to current use, with active extraction occurring for potable and irrigation uses. The potential use of basal groundwater for drinking water purposes is the most conservative scenario used as a basis for reasonable exposure assessment assumptions and risk characterization conclusions discussed in Section 7.0.

7 Summary of Site Risks

A Baseline Risk Assessment (BRA) was prepared in 1999 by Del Monte's consultants with EPA and State oversight (Golder and GlobalTox, 1999). The BRA was prepared in accordance with EPA guidance (EPA Risk Assessment Guidance for Superfund, Parts A-D (RAGS) (EPA 1989a, 1991b, 1991c, 1991d, 1998a)).

The BRA estimates the human health and environmental risks that the site could pose if no action were taken. It is one of the factors that EPA considers in deciding whether to take action at a site. The risk assessment is also used to identify the contaminants and exposure pathways that need to be addressed by the remedial action. At the Del Monte Site, EPA's decision to take action is based principally on the potential future risks to Kunia Village residents and downgradient residents within 1.5 miles of the KVA if no cleanup actions were taken to address contaminated groundwater. This section of the ROD summarizes the results of the BRA for the Del Monte Site.

7.1 Summary of Human Health Risk Assessment

This summary of human health risk includes sections on the identification of COCs, exposure assessment, toxicity assessment, and risk characterization. As is described above in Section 5.8 and in more detail in the BRA (Golder and GlobalTox, 1999), the only exposure pathways that are complete or potentially complete and contribute substantially to the estimated risks are groundwater-related pathways. Thus, this section focuses only on risk associated with various current and future groundwater exposure scenarios.

7.1.1 Identification of Chemicals of Concern

This section describes the screening process used to determine the COPCs that were retained for evaluation in the BRA. The approach was conducted in accordance with RAGS Part A, Section 5.9, which describes screening as an essential aspect of producing a risk assessment that evaluates constituents that are important at a site. These important constituents are the COPCs. The results of the BRA are used to determine which of the COPCs should be considered as COCs for the Site.

For the BRA, EPA Region IX PRGs (EPA, 1999) were used to represent the Screening Toxicity Values. PRGs are risk-based screening tools used for evaluating contaminated sites. If the maximum value for a chemical detected in a medium does not exceed the screening value, it does not represent a significant risk and was not carried further through the risk characterization process. Conversely, if the maximum value detected in a medium exceeds the screening value it may represent a potential risk and is retained for further risk characterization analysis. Specifically, the PRGs applied as Screening Toxicity Values were the residential tap water PRGs established for exposure to groundwater through ingestion, dermal contact, and inhalation of volatile organic compounds.

<u>Summary of COPC Screening for Groundwater</u> – The maximum concentrations of several constituents detected during RI and post-RI sampling activities at the Kunia Village and Basal Wells exceeded the EPA Region IX PRGs. These constituents included EDB, DBCP, DCP, and TCP. Table 7 provides detailed information on the range of concentrations detected, the frequency of detection and the exposure point concentrations used for current and future exposure scenarios for each of these constituents. These same constituents were detected during regional groundwater sampling at the HCC Well. As shown in the table, EDB and DBCP were the most frequently detected COCs in groundwater at the site.

The arithmetic mean concentration shown in Table 7 was used for the calculations of "average" potential risk and either the maximum detected concentration or the 95th percentile (95%) upper confidence limit (UCL) on the arithmetic mean concentration (whichever was lower) was used as the exposure point concentration for calculating the maximum potential risk for each COC in each well group.

7.1.2 Exposure Assessment

Exposure refers to the potential contact of an individual (or receptor) with a chemical. Exposure assessment is the determination or estimation of the magnitude, frequency, duration, and route of potential exposure. The exposure assessment methodology used in the BRA follows the procedures outlined in Chapter 6 of RAGS, Part A (EPA, 1989a). This section briefly summarizes the potentially exposed populations, the exposure pathways evaluated, and the exposure quantification from the BRA performed for the Del Monte Site. Considerably more detail on the exposure assessment can be found in the RA (Golder and GlobalTox, 1999).

Potential human exposures under current conditions were evaluated based on the assumption that the reasonable maximum exposure scenario is inhalation exposure to untreated HCC well water by HCC golf course maintenance workers. Only the inhalation pathway is evaluated because ingestion and dermal contact to irrigation water by maintenance workers is expected to be minimal. Water used for drinking at the golf course is currently treated so this exposure route is not applicable. There is no current exposure to contaminants in basal groundwater in the KVA because the Kunia and Basal Wells are not used for drinking water purposes. There are no other current receptors with substantive exposures to contaminated groundwater.

Hypothetical future human exposure scenarios were evaluated to assess whether response actions may be necessary to address potential future risks. Hypothetical future receptors are assumed to be:

- Kunia Section irrigation workers and residents exposed through inhalation (for spray irrigation workers) and dermal contact (for drip irrigation workers) with contaminants from the use of Kunia Well water without treatment.

- Hypothetical, future residents exposed to potentially contaminated groundwater, without treatment, through ingestion, inhalation and dermal contact at 1.5 miles downgradient (near the HCC Well), 3 miles downgradient, and 4.5 miles downgradient of the KVA. Residential exposure to contaminants could occur through the use of groundwater for domestic purposes, such as ingestion of tap water, inhalation of contaminants from water used for bathing, cooking and laundering, and dermal contact with the water.

  The 1.5-mile increment is based upon future hypothetical residential use of untreated groundwater from the HCC Well. The 3-mile increment would represent untreated groundwater between the HCC and Honouliuli II Wells while the 4.5-mile increment would represent untreated groundwater located near the aquifer boundary of the Honouliuli Wells. It should be noted that the fate and transport modeling indicates that the Honouliuli II Well will never be impacted above MCLs by contaminants from the Kunia Village Area under current and future conditions.

Based on potential for exposure frequency, duration, and estimated intake, potential residents exposed to contaminated groundwater used for domestic purposes are expected to be the maximally exposed population. The assumption that residents could be exposed to untreated groundwater from the Kunia Village Well or other downgradient production wells that become contaminated is conservative. There are not currently any wells serving untreated water for public drinking water supply from the contaminated portions of the basal aquifer. Further, regulations, such as the Safe Drinking Water Act and Hawaii drinking water regulations, currently prohibit water purveyors from serving water contaminated in excess of drinking water standards to consumers.

7.1.3 Toxicity Assessment

The toxicity assessment identifies chemical-specific toxicity factors for each COC for the purpose of determining individual and cumulative noncancer (i.e., Hazard Quotients [HQs]) and cancer (i.e., Incremental Cancer Risk [ICR]) risk values for the BRA. Table 8 shows the four COCs that are the major risk contributors for the Del Monte Site RA.

Toxicity values have been developed for evaluating potential human carcinogenic effects from exposure to carcinogens. Potential human carcinogenic effects are evaluated using the chemical-specific slope factor and accompanying EPA weight-of-evidence determination. Slope factors have been derived by EPA (and are published in the Integrated Risk Information System (IRIS) (EPA, 1997) or the Health Effects Assessment Summary Tables (HEAST) (EPA, 1998)) based on the concept that for any exposure to a carcinogenic chemical there is always a carcinogenic response (i.e., no threshold level exists). Slope factors are used in risk assessment to estimate an upper-bound lifetime probability of an individual developing cancer as a result of a specific exposure to a carcinogen.

A weight-of-evidence classification is assigned to carcinogenic substances based on the strength of human and animal evidence of carcinogenicity. The EPA weight-of-evidence classifications are as follows:

Group A - Human carcinogen
Group B - Probable human carcinogen
Group B1 - Limited evidence of carcinogenicity in humans
Group B2 - Sufficient evidence of carcinogenicity in animals with inadequate or a lack of evidence in humans
Group C - Possible human carcinogen
Group D - Not classifiable as to human carcinogenicity
Group E - Evidence of non-carcinogenicity in humans

Based on data from various animal studies and other scientific evaluations, all four COCs for basal groundwater (EDB, DBCP, DCP, and TCP) are classified as probable (B2) human carcinogens for an oral route of exposure. EDB and DBCP are also classified as probable human carcinogens for the inhalation route. The carcinogenic oral slope factors (toxicity values) for these four compounds are shown in Table 8. The inhalation slope factors for EDB and DBCP are also presented in Table 8.

At this time, slope factors are not available for the dermal route of exposure. Thus, the dermal slope factors used in the assessment have been extrapolated from the oral slope factors. A chemical-specific oral-to-dermal adjustment factor is sometimes applied to the oral slope factor and is dependent upon how well the chemical is absorbed via the oral route. However, adjustment is not necessary for the COCs evaluated at this site. Therefore, the same carcinogenic slope factors presented in Table 8 for the oral route are used for the dermal route (see Table 8).

Systemic, toxic effects (other than cancer) may be associated with exposures to the COCs at the Del Monte Site. The toxicity value used to evaluate potential noncancer (i.e., noncarcinogenic) effects is the reference dose (RfD). The RfD has been developed by EPA based on the assumption that thresholds exist for certain toxic effects. In other words, a certain amount (i.e., dose) of the chemical is required to be ingested, inhaled or absorbed through the skin to produce an undesirable noncancer health effect. In general, the RfD is an estimate of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without a significant risk of noncancerous effects during a lifetime. The RfD is developed to reflect the duration of exposure and the route of exposure (such as inhalation or ingestion).

The RfD has been developed based on dose-response data obtained from animal or human studies with additional safety factors applied to reflect uncertainty in the information, as appropriate. The RfDs and primary target organs, as published by EPA in IRIS (EPA, 1997), HEAST (EPA, 1998), or Region IX PRG Toxicity Tables (EPA, 1999), are presented in Table 8.

RfDs have been developed for oral and inhalation routes of exposure, but not for dermal exposure. As was the case for the carcinogenic factors, the oral RfDs are used directly without adjustment to represent the dermal RfDs (see Table 8).

7.1.4 Risk Characterization

This section presents the results of the evaluation of the potential risks to human health associated with exposure to contaminated groundwater at the Del Monte Site. Exposure scenarios are evaluated by estimating the noncarcinogenic and carcinogenic risks associated with them.

For carcinogens, risks are generally expressed as the incremental probability of an individual developing cancer over a lifetime as a result of exposure to the carcinogen. These risks are probabilities that usually are expressed in scientific notation (e.g., 1×10^{-6}). An excess lifetime cancer risk of 1×10^{-6} indicates that an individual has a 1 in 1,000,000 chance of developing cancer as a result of site-related exposure. This is referred to as an "excess lifetime cancer risk" because it would be in addition to the risks of cancer individuals face from other causes such as smoking or exposure to too much sun. The chance of an individual developing cancer from all other causes has been estimated to be as high as one in three. EPA's generally acceptable risk range for site-related exposures is 10^{-4} to 10^{-6}. An excess lifetime cancer risk of greater than one in ten thousand (1×10^{-4}) is the point at which action is generally required at a site (EPA, 1991a).

The potential for noncarcinogenic effects is evaluated by comparing an exposure level over a specified time period (e.g., a lifetime) with a RfD derived for a similar exposure period. The ratio of exposure to toxicity is called an HQ. An HQ less than one indicates that a receptor's dose of a single contaminant is less than the RfD and that toxic noncarcinogenic effects from exposure to that chemical are unlikely. HQs for all COCs that affect the same target organ (e.g., liver) are added together to generate the Hazard Index (HI). An HI less than one indicates that noncarcinogenic effects from all the contaminants are unlikely. Conversely, an HI greater than one indicates that site-related exposures may present a risk to human health.

Conclusions

Tables 9 and 10 present the risk characterization summaries for carcinogenic (Table 9) and noncarcinogenic effects (Table 10). The risk estimates presented in these tables are based on reasonable maximum exposure (RME) and were developed by taking into account various conservative assumptions about the frequency and duration of exposure to groundwater, as wells as the toxicity of the primary COCs.

Key results for each exposure scenario are as follows:

Current HCC irrigation workers – The receptor for this scenario is a HCC golf course maintenance worker that may be exposed to irrigation spray for 2.8 hours per day, 245 days per year. During this time the worker may be operating the dry faucet valves of the system or maintaining golf course greens near the sprinkler irrigation system and is potentially exposed to contaminants volatilized from the irrigation water through ambient air inhalation.

The estimated excess lifetime cancer risk of 5.5×10^{-7}. The highest estimated risk comes from potential inhalation exposure to TCP (i.e., 5.4E-07). None of the chemicals of potential concern exceed an HQ of 1 for the exposure pathway. The HI for all contaminants via the inhalation pathway is 0.001. Because the cancer risks are less than 1×10^{-6} and the hazard quotient less than 1.0, continued use of HCC well water for irrigation activities is acceptable.

Hypothetical future Kunia Village residential exposure to untreated Kunia Well water - The receptor for this scenario is a future, hypothetical Kunia Village resident that may be exposed to contaminants in untreated basal groundwater from the Kunia Well. During a lifetime the resident would potentially be exposed through ingestion of potable water, direct dermal contact through residential water use (i.e., showering, bathing, laundry activities) and ambient air inhalation of contaminants volatilized from the water during residential use.

The estimated excess lifetime cancer risk for this scenario is 9.1×10^{-4}. The highest estimated risk comes from inhalation exposure to TCP (4.9×10^{-4}). Inhalation exposure to DBCP exceeds an HQ of 1 (HQ = 2.5). The HI for all contaminants and pathways is 4.1. Therefore, the excess lifetime cancer risk for this scenario exceeds the lower end of EPA's generally acceptable risk range of 10^{-4} to 10^{-6} and the HI greater than one indicates that exposures may present a noncarcinogenic risk to human health.

Hypothetical future Kunia Section irrigation workers potentially exposed due to use of untreated Kunia Well water for irrigation – The receptor for this scenario is a future hypothetical irrigation worker (either drip or spray) that works approximately 2.8 hours per day, 245 days per year (drip) or 3.1 hours per day, 252 days per year (spray). During this time the drip irrigation worker would be potentially exposed to through direct dermal contact to hands and arms during the installation or repair of drip tubing with untreated Kunia Well groundwater. The spray irrigation worker is driving an irrigation truck up and down the field roads irrigating the Kunia Section of the plantation and would be potentially exposed to COCs that volatilize from the untreated irrigation water and could be inhaled through ambient air. Again, the use of untreated basal groundwater from the Kunia Well is not expected and is estimated for risk assessment purposes only.

The estimated excess lifetime cancer risk is 5.8×10^{-6} (drip workers) and 6.2×10^{-5} (spray workers). The highest estimated risk for the drip irrigation worker comes from dermal exposure to EDB and TCP (3.5×10^{-6} and 2.1×10^{-6}, respectively). For the spray worker, the highest estimated risk is from inhalation exposure to TCP (6×10^{-5}). None of the contaminants exceed an HQ of 1 for the exposure pathways evaluated. The HI is 0.01 for the dermal pathway (drip worker) and 0.5 for the inhalation pathway (spray worker). The excess lifetime cancer risk for both of these scenarios exceeds the lower end of EPA's generally acceptable risk range of 10^{-4} to 10^{-6} and the HI less than one indicates that exposures do not present a noncarcinogenic risk to human health.

Hypothetical future (1.5 mile) downgradient residential exposure via untreated groundwater use - The receptor for this scenario is a future, hypothetical resident living 1.5 miles downgradient of the KVA that may be exposed to contaminants in untreated basal groundwater from the HCC Well. Potential residential exposure conditions are described above.

For the 1.5 mile location the estimated excess lifetime cancer risk is $1.7x10^{-4}$. The highest estimated risk comes from inhalation exposure to TCP ($1.1x10^{-4}$). The remainder of the estimated risk is due to ingestion of groundwater containing EDB, DBCP, and TCP. Inhalation exposure to DBCP exceeds an HQ of 1 (HQ = 1.8). The HI for all contaminants and pathways is 2.4. The excess lifetime cancer risk for this scenario exceeds EPA's acceptable risk range of 10^{-4} to 10^{-6} and the HI greater than one indicates that exposures may present a noncarcinogenic risk to human health.

Hypothetical future (3 mile) downgradient residential exposure via untreated groundwater use - The receptor for this scenario is a future, hypothetical resident living 3 miles downgradient of the KVA that may be exposed to contaminants in untreated basal groundwater extracted from the middle of a hypothetical plume originating in the KVA. During a lifetime, the resident may potentially be exposed through ingestion of untreated groundwater, direct dermal contact through residential untreated water use (i.e., showering, bathing, laundry activities) and ambient air inhalation of contaminants volatilized from untreated water during residential use.

For the 3 mile location the estimated excess lifetime cancer risk is $9.4x10^{-6}$. The highest estimated risk comes from oral ingestion exposure to EDB ($5.1x10^{-6}$). None of the contaminants exceed an HQ of 1 for the exposure pathways evaluated. The HI for all contaminants and pathways is 0.04. The excess lifetime cancer risk for this scenario is near the middle of EPA's generally acceptable risk range of 10^{-4} to 10^{-6}. The HI is well below one, indicating that exposures do not present a noncarcinogenic risk to human health.

Hypothetical future (4.5 mile) downgradient residential exposure via untreated groundwater use - The receptor for this scenario is a future, hypothetical resident living 4.5 miles downgradient of the KVA that may be exposed to contaminants in untreated basal groundwater extracted from the middle of a hypothetical plume originating in the KVA (the Honouliuli II Wells are located approximately 4.5 miles downgradient of the KVA) . During a lifetime, the resident may potentially be exposed through ingestion of untreated groundwater, direct dermal contact through residential untreated water use (i.e., showering, bathing, laundry activities) and ambient air inhalation of contaminants volatilized from untreated water during residential use.

For the 4.5 mile location the estimated excess lifetime cancer risk is $6.1x10^{-6}$. The highest estimated risk comes from oral ingestion exposure to EDB ($3.3x10^{-6}$). None of the contaminants exceed an HQ of 1 for the exposure pathways evaluated. The HI for all contaminants and pathways is 0.02. The excess lifetime cancer risk for this scenario falls in the lower end of EPA's generally acceptable risk range of 10^{-4} to 10^{-6} and the HI greater than one indicates that exposures do not present a noncarcinogenic risk to human health.

It should be noted that all of the scenarios described above involving potential future exposure to contaminated groundwater are very unlikely to occur because Safe Drinking Water Act (SDWA) and State of Hawaii regulations prohibit water purveyors from serving groundwater containing contaminants at concentrations that exceed their State or Federal drinking water standards (MCLs).

Several assumptions used in the BRA evaluation contribute uncertainty to the risk assessment. Key uncertainties include:

- Uncertainty with the assumption that the 95% upper confidence limit value or the maximum detected value are representative of contaminant concentrations in each medium. These are conservative estimates that likely overstate the expected exposure point concentrations.

- Uncertainty is present in the assumptions and factors used to produce the route-specific exposure point concentrations for several exposure scenarios (i.e., route-specific air concentrations estimated for HCC spray irrigation; route-specific concentrations derived for hypothetical, future, untreated irrigation water for the Kunia Section).

- Uncertainty associated with the exposure factors and parameters used in the exposure assessment. These included the exposure setting, scenarios, pathways, and receptors developed in the conceptual site model. Additional uncertainty was associated with adjusting standard EPA occupational scenario parameters (i.e., adjusted site-specific parameters were used for the future hypothetical Kunia Section irrigation workers (drip and spray) and the current HCC maintenance worker scenarios). These adjusted parameters represent upper bound estimates for contaminant intake, exposure duration, and body weight that may overestimate risk.

- Uncertainty associated with the toxicity assessment that extrapolates toxicological information derived from animal studies. These data were used to predict human health effects from exposure to environmental media that may not provide a comparable dose. Uncertainty is also introduced by a lack of toxicity data for several chemicals of potential concern that rely on route-to-route (i.e., oral for inhalation) extrapolated toxicity values.

7.2 Summary of Ecological Risk Assessment

Ecological risks are evaluated qualitatively because very few shallow soil and sediment samples contained detectable COPCs. In addition, because the former excavation pit was backfilled during October 1999, the only potential pathway for ecological receptors has been eliminated. Furthermore, because there is no physical connection of perched water (with the exception of the former excavation pit prior to backfilling) with surface receptors, an exposure pathway does not exist for perched groundwater. The RI found that perched groundwater does not discharge to surface water as evidenced by the low hydraulic heads in the perched aquifer in the vicinity of the ephemeral gulch, nor were any seeps or springs noted. It is also important to note that the KVA does not provide critical habitat for threatened and endangered species and typical location-specific laws and regulations that apply to wetlands and historic places are not appropriate nor applicable to this site. Therefore, the qualitative, screening-level ecological risk assessment demonstrates that no current risk is attributable to the KVA because no pathways of exposure leading to ecological receptors are present.

7.3 Conclusion

In addition to the risk assessment, EPA has considered the state and federal drinking water standards (MCLs and maximum contaminant level goals [MCLGs]) that have been established for contaminants found at the Del Monte Site. MCLs and MCLGs are set at levels, including an adequate margin of safety, where no known or anticipated adverse health effects are expected to occur. Even if the cumulative carcinogenic site risk to an individual based on reasonable maximum exposure is less than 10^{-4} and the non-carcinogenic hazard quotient is less than 1, remedial action will generally be warranted if MCLs or non-zero MCLGs are exceeded ("Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions," OSWER Directive 9355.0-30, April 22, 1991a).

Based on the risk characterization results (Tables 9 and 10) that show potential cancer and noncancer risks to Kunia Village and downgradient residents within 1.5 miles of the KVA exceeding acceptable levels, the presence of contamination in excess of drinking water MCLs in the basal aquifer, and the use of groundwater in the Del Monte Site vicinity as a source of irrigation and drinking water, EPA has determined that actual or threatened releases of hazardous substances at this site, if not addressed by implementing the response action selected in this ROD, may present an imminent and substantial endangerment to public health, welfare, or the environment. As described in the preceding paragraphs, the groundwater contamination does not represent a current threat to public health or welfare, but rather a potential future threat.

8 Remediation Objectives

EPA's Remedial Action Objectives (RAOs) for the Del Monte Site are to:

- Prevent exposure of the public to contaminated groundwater above chemical-specific cleanup levels (described below);
- Inhibit further migration of the contaminant plume away from the KVA (source control);
- Limit discharge of Kunia Village Area perched groundwater and deep soil contaminants to basal groundwater such that basal groundwater concentrations do not exceed the chemical-specific cleanup goals described below (source control), and;
- Restore basal groundwater to its beneficial use of drinking water supply within a reasonable timeframe (aquifer restoration).

These objectives reflect EPA's regulatory goal of restoring usable groundwater to its beneficial uses wherever practicable, within a timeframe that is reasonable, or, if restoration is deemed impracticable, to prevent further migration of the plume, prevent exposure to the contaminated groundwater, and evaluate further risk reduction (40 C.F.R. Section 300.430{a}{1}{iii}{F}). The RAOs address the risks associated with exposure to contaminated groundwater at the Del Monte Site (described above in Section 7) by significantly limiting the potential for future exposure.

To meet the RAOs, migration control will be required in the Kunia Village basal aquifer source area as long as contaminant concentrations in groundwater exceed cleanup levels and downgradient actions will be required until the entire area of contamination meets the cleanup levels. The RAOs for the Del Monte Site incorporate the following, chemical-specific cleanup levels in the basal aquifer. As the table indicates, EPA has selected MCLs as the cleanup levels in the basal aquifer. MCLs (sometimes called drinking water standards) are regulatory limits that apply to drinking water served for consumption. EPA has selected the State of Hawaii MCLs as the cleanup level for three of the COCs because they are lower than the Federal MCLs.

Chemical of Concern	Federal MCL (µg/L)	Hawaii State MCL (µg/L)	EPA Cleanup Level (µg/L)
EDB	0.05	0.04	0.04
DBCP	0.2	0.04	0.04
TCP	---	0.6	0.6
DCP	5	5	5

9 Description of Alternatives

EPA evaluated three perched groundwater alternatives and three basal groundwater alternatives for the Del Monte Site:

Perched Aquifer Alternatives

- Alternative P1 - No Action Alternative
- Alternative P2 - Groundwater Extraction and Treatment with Capping
- Alternative P3 - Groundwater Extraction and Treatment with Capping and Soil Vapor Extraction (SVE)

Basal Aquifer Alternatives

- Alternative B1 - No Action Alternative
- Alternative B2 - Phased Groundwater Extraction and Treatment with Contingent Monitored Natural Attenuation
- Alternative B3 - Groundwater Extraction and Treatment in the Source Area and the Downgradient Plume

A brief description of the three perched aquifer and three basal aquifer remedial alternatives is presented below.

9.1 Perched Aquifer Alternatives

Perched aquifer remediation will address subsurface remediation above the basal aquifer in the KVA. Perched aquifer remediation addresses perched groundwater and deep soils.

9.1.1 Alternative P1 – No Action

The NCP requires EPA to consider a no action alternative and to evaluate the risk to the public if no action were taken. The No-Action Alternative provides a baseline for comparison with other remedial alternatives under consideration. In this alternative, no remedial actions would be taken to control continued migration of contaminants from the perched aquifer down to the basal aquifer in the Kunia Village source area. This alternative does not include any active response such as groundwater monitoring or extraction so there is no cost associated with this alternative. The No-Action Alternative allows continued, uncontrolled migration of contamination into the basal aquifer.

9.1.2 Alternative P2 – Groundwater Extraction and Treatment with Capping

This alternative would include backfilling the pit (already completed) and placing a vegetated soil cap over the source area to further limit surface water recharge to the perched aquifer. Groundwater extraction would be conducted via a system of extraction wells to remove chemical mass and lower hydraulic heads in the perched aquifer. . This alternative is essentially a hydraulic containment alternative. Extracted groundwater would be treated via a phytoremediation treatment system, or a physical treatment system if phytoremediation proves to be ineffective. Del Monte has been successfully operating a phytoremediation treatment system for the perched groundwater since 1998. The system was installed as a Treatability Study during the RI/FS.

The major components of this alternative are:

- Backfilling the pit (already completed)
- Construction of a soil cap over the most affected area of the perched aquifer, including appropriate storm water controls
- Installation of a groundwater extraction system (already completed) to provide hydraulic containment that reduces the mass flux of COCs into the underlying basal aquifer
- Treatment of the extracted groundwater via phytoremediation or, if necessary, physical treatment
- Implementing institutional controls to prevent exposure to perched groundwater and soil impacted by COCs and to prevent activities that might interfere with the effectiveness of the remedy
- Operation of the groundwater extraction and treatment system until the impact of the perched aquifer on the basal aquifer is reduced to remediation goals
- Monitoring groundwater for the foreseeable future or for more than 30 years
- Cap maintenance and monitoring for the foreseeable future or for more than 30 years
- Maintenance of institutional controls for the foreseeable future or for more than 30 years

Soil Cap

Capping is a cost-effective means of reducing mass flux out of the perched aquifer by reducing infiltration. Capping would include the pit area that has been backfilled and the rest of the source area.

The soil cap will primarily consist of regrading the perched aquifer source area to provide proper stormwater drainage. The cap soil would be clean compacted Kolekole loam soil fill with topsoil for the top six inches. To establish vegetation, the topsoil would be seeded with grasses suitable for the local climate. The vegetated cover will promote evapotranspiration and decrease erosion.

Stormwater diversion swales would be constructed around the source area. The grading and stormwater diversion would serve two purposes: they would reduce infiltration of stormwater run-on, and they would minimize erosion of the soil cap.

Design assumptions for this remedy component are as follows:

- Cap area: 12,000 square feet
- Cap thickness: 3 feet
- Total fill volume (cap and backfill): 14,000 cubic yards
- Total stormwater ditch length: 1,000 feet

Groundwater Extraction

Groundwater extraction for the perched aquifer is intended to reduce the mass flux of COCs entering the underlying basal aquifer from the perched aquifer. Groundwater extraction would be accomplished by pumping from existing wells in the source area that were installed to support the phytoremediation treatability study, in addition to historical wells No. 3 and No. 9.

The existing collection tank would be used to isolate the treatment system from flow surges as pumps turn on and off. The collection tank would also provide holding capacity to allow groundwater extraction to continue a short time (up to several weeks depending on the production rate from the extraction wells) when the treatment system is taken offline for maintenance. Conversely, the collection tank would also allow the treatment system to operate for a short time during extraction system maintenance.

Design assumptions for this remediation component are as follows:

- Number of extraction wells pumped: 14
- Flow rate per well (average): 0.1 gpm
- Total extraction rate (average): Approximately 1 gpm

Groundwater Treatment

Phytoremediation (treatment using plants) would be used to treat the extracted perched groundwater. If necessary, physical treatment, which is a proven technology, could be used if problems are encountered with the phytoremediation.

Phytoremediation is an enhancement of land treatment. Extracted groundwater is used to irrigate phytoremediation cells. Both soil microbes and Koa Haole plants biologically degrade EDB and DBCP in the cells. In addition, the plants enhance evapotranspiration, which maximizes the amount of extracted water containing COCs that can be applied to the treatment cells. To minimize volatilization, subsurface drip irrigation is used.

Based on the estimated perched groundwater extraction rate, the pilot treatment system already installed would be sufficient for full-scale treatment of perched groundwater. The pilot treatment cells are lined with 80-mil high-density polyethylene, and include a closed loop leachate recovery system. All leachate is reused as irrigation water in the phytoremediation cells.

Design assumptions for this remedy component are as follows:

- Influent groundwater rate: Approx. 1 gpm (10,000 gallons/week)
- Treatment cell size (2 units): 150 feet long, 50 feet wide, and 4 feet deep
- Treatment system capacity (existing pilot system): 10,000 – 20,000 gallons/week.

The backup option of physical treatment of perched groundwater could be accomplished most cost-effectively using a combination of air stripping and carbon adsorption. Air stripping is a conceptually simple process wherein air and water flow countercurrent (i.e., in opposite directions) in a tower. The air extracts volatile compounds from the water. This air (off-gas) is treated to remove COCs if required by applicable air regulations, and then discharged into the atmosphere. Following the air stripper the water would be treated using liquid-phase carbon absorption. Liquid-phase carbon adsorption contacts water with granular activated carbon; COCs are removed from the water by adsorbing onto the carbon. The carbon is then disposed of or regenerated (treated to destroy contaminants and allow reuse of the carbon). Carbon disposal or regeneration would occur off-site at a permitted facility.

The two-process system (both air stripping and liquid-phase carbon adsorption) would be used to minimize overall treatment cost. Treatment of air emissions is not required for sources less than 0.1 tons/year of the COCs. It is expected that air emissions would not exceed this limit. However, due to the proximity of the treatment system to Del Monte offices, workers, and residents, off-gas treatment would be provided using vapor-phase carbon adsorption. Vapor-phase carbon adsorption is similar to liquid-phase carbon adsorption, except that the carbon removes COCs from air instead of water.

Institutional Controls

Institutional Controls for Alternative P2 would prohibit certain activities unless such activities are first reviewed and approved by EPA. These prohibited activities include the following:

- Activities that would damage or affect the integrity of the cap in the KVA. Such activities include, but are not limited to, excavating into the cap or contaminated soil, or building on the cap;
- Activities, such as movement of earth, that would interfere with the effectiveness of stormwater diversion swales or the cap grade;
- Activities that will damage or affect the integrity of the phytoremediation cells, and
- Activities that would damage or interfere with the groundwater monitoring, extraction wells and related facilities associated with the perched aquifer remedy.

Appropriate fencing would be included to prevent access to groundwater extraction and treatment systems and surface remedies (i.e., “cap”). Appropriate warning signs will also be put into place.

Monitoring

For the perched aquifer, groundwater monitoring will be conducted until the RAOs for the perched aquifer are achieved. COC concentrations will slowly continue to decrease even after remedial action is complete. Perched aquifer monitoring will include: the extraction wells and monitoring wells installed for the phytoremediation study; pre-RI extraction wells 3 and 9; and monitoring wells MW-1 through MW-21 installed during and subsequent to the RI that contain sufficient water to sample. Head measurements will be obtained to document dewatering and containment of the perched groundwater and water samples from selected wells will be analyzed for VOCs including EDB and DBCP. Monitoring is expected to be necessary for greater than 30 years.

Performance monitoring will also be performed for treatment components of the alternatives. Treatment monitoring would include sampling and analysis of influent and effluent groundwater. It is expected that soil sampling will be needed for phytoremediation to track potential buildup of COCs in soil.

In addition to groundwater monitoring, maintenance and monitoring of components of the remedy (cap and fencing) will be performed. Maintenance and monitoring will continue so long as groundwater extraction and treatment continues. Therefore, the cap will be maintained for greater than 30 years.

Remediation Timeframe

Alternative P2 could potentially meet remediation goals in the basal aquifer within three to seven years of remedy startup. However, once the pumping system is turned off, recharge to the saprolite will cause it to become resaturated and contaminants in the previously dewatered portions of the perched aquifer will again come into contact with saturated groundwater with subsequent infiltration and recharge to the basal aquifer. An estimate of the mass of EDB and DBCP removal achievable by groundwater pumping can be made from the records and monitoring of the perched aquifer phytoremediation treatability study. The estimated mass of EDB, DBCP and 1,2,DCP removed from perched groundwater as of May 2000 is about 11 grams, 32 grams and 163 grams, respectively. The total percentage of COCs removed from soils during this period is only 0.1 percent. Therefore, the mass removal of COCs from pumping will not reduce the mass of COCs in the vadose zone significantly and remediation is expected to take longer than 30 years.

9.1.3 Alternative P3 - Groundwater Extraction and Treatment with Capping and Soil Vapor Extraction

This alternative is identical to Alternative P2, however, deep soils would also be treated via SVE. SVE would be used to accelerate the time to reach the mass flux remediation goals for the perched aquifer. There is some uncertainty regarding the effectiveness of SVE in the low permeability saprolite materials of the perched aquifer. Performance of a pilot test will be required to evaluate design issues and assess performance. If SVE proves to be effective, this alternative has the potential to achieve RAOs more quickly than Alternative P2.

The soil capping, groundwater extraction, and groundwater treatment components are the same as described above for Alternative P2, so these sections are not repeated below. The major components of this alternative are:

- Backfilling the pit (already completed).
- Construction of a soil cap over the most affected area of the perched aquifer, including appropriate storm water controls.
- Installation of a groundwater extraction system to provide hydraulic containment that reduces the mass flux of COCs into the underlying basal aquifer and depresses the groundwater elevation for SVE.
- Treatment of the extracted groundwater via phytoremediation or, alternatively, physical treatment.
- Installation of a SVE system in the most affected area of the perched aquifer to remove COCs from unsaturated soils to reduce perched aquifer impacts on the basal aquifer more quickly.
- Implementation of institutional controls to prevent exposure to perched groundwater and soil impacted by COCs and to prevent activities that would interfere with the effectiveness of the remedy.
- Operation of the groundwater extraction and treatment and SVE systems (with off-gas treatment) until the impact of the perched aquifer on the basal aquifer is reduced to remediation goals.

- Monitoring groundwater until remediation goals are achieved and can be shown to be maintained after active remediation is terminated.
- Cap maintenance and inspection monitoring will continue until remediation goals are achieved and post-operation monitoring of basal groundwater is complete.
- Maintenance of institutional controls until remediation goals are achieved.

Soil Vapor Extraction (SVE)

For Alternative P3, SVE would be used to accelerate the rate of COC removal. SVE would primarily be used to accelerate the time to reach the mass flux remediation goals for the perched aquifer. SVE would be used in conjunction with groundwater extraction. The water level drawdown provided by groundwater extraction would enable the SVE treatment to extend deeper into the perched aquifer.

SVE would be accomplished with a vacuum blower to extract subsurface vapors via a piping network from SVE wells. Piping would be laid aboveground within a fenced area. Existing groundwater wells would be used in a dual role, for both groundwater extraction and SVE. Additional SVE wells would be installed as needed to provide the desired treatment coverage.

The air permeability of the perched zone has not been determined. Based on the measured hydraulic conductivity and the clayey nature of the soil, the subsurface air permeability is expected to be small, meaning that the radius of influence of SVE wells would be small.

Under State of Hawaii regulations, treatment of air emissions is not required for sources less than 0.1 tons/year of the COCs. It is expected that air emissions would not exceed this limit. However, to minimize risks during remedial activities, off-gas treatment will be provided using vapor-phase carbon. Spent carbon would be sent off-site for regeneration or disposal at a permitted facility.

Design assumptions for this remediation component are as follows:

- Number of dual-use wells: 35
- Number of additional SVE wells: 55 (approximate)
- SVE header piping: 4-in. diam. PVC, 250 feet
- Vacuum blower capacity: 200 scfm
- Off-gas treatment: Carbon adsorption

Pilot testing will be required for design purposes to determine the radius of influence and other operating parameters. The layout of the system and eventual number of additional SVE wells needed would be determined on the basis of pilot testing results.

Monitoring

Monitoring is the same as described above for Alternative P2 except the monitoring duration for Alternative P3 is estimated to be 10 to 15 years.

Institutional Controls

Institutional Controls for Alternative P3 would prohibit certain activities unless such activities are first reviewed and approved by EPA. These prohibited activities include the following:

- Activities that would damage or affect the integrity of the cap in the KVA. Such activities include, but are not limited to, excavating into the cap or contaminated soil, or building on the cap;
- Activities, such as movement of earth, that would interfere with the effectiveness of stormwater diversion swales or the cap grade;
- Activities that will damage or affect the integrity of the phytoremediation cells,
- Activities that would damage or interfere with the groundwater monitoring, extraction wells and related facilities associated with the perched aquifer remedy, and
- Activities that would damage or interfere with the effectiveness of the SVE system.

Appropriate fencing would also be included to prevent access to groundwater extraction and treatment systems and surface remedies (i.e., “cap”). Appropriate warning signs will also be put into place.

Remediation Timeframe

For the remediation to be complete, contaminant concentrations in the deep soils and perched groundwater must be reduced sufficiently such that the mass flux of remaining contamination would not cause exceedances of cleanup standards in the basal aquifer. Pilot testing will be required to estimate key SVE parameters necessary to assess the effectiveness of SVE at removing contaminants from the perched zone. Because pilot testing has not been completed, engineering judgment was used to develop reasonable assumptions for the mass removal analysis. Based on the assumptions used in the FS, the restoration timeframe is estimated to be approximately 8 years after full-scale startup of the SVE system.

Given the lack of pilot test data and other uncertainties, this analysis should only be considered a rough approximation of what will actually occur. The timeframe will likely be constrained by diffusion of contaminants in the heterogeneous perched aquifer soils. SVE airflow is typically through relatively more permeable horizons in the soil, with contaminants diffusing from the less permeable soils. The extent that diffusion is limited cannot be accurately predicted without testing. This is a key area of uncertainty in estimating the remediation timeframe.

9.2 Basal Aquifer Alternatives

Basal aquifer alternatives address contaminated groundwater in the “basal source area” and the “downgradient plume.”

9.2.1 Alternative B1 – No Action

As described above in Section 9.1.1, the NCP requires EPA to consider a no action alternative and to evaluate the risk to the public if no action were taken. The No-Action Alternative provides a baseline for comparison with other remedial alternatives under consideration. In this alternative, no remedial actions would be taken to control continued migration of contaminants away from the KVA source area and the downgradient plume would not be addressed. This alternative does not include any active response such as groundwater monitoring or extraction so there is no cost associated with this alternative. The No-Action Alternative allows continued, uncontrolled migration of groundwater contamination and does not meet EPA's RAOs.

9.2.2 Alternative B2 – Phased Groundwater Extraction and Treatment with Contingent Monitored Natural Attenuation

This alternative includes deferred site characterization to define the source area and the downgradient plume and monitoring to determine the effectiveness of source control and to determine which remedy to implement for the downgradient plume. Groundwater would be extracted in a phased manner, beginning with the basal aquifer source area to remove the source of Site COCs from the downgradient plume. Extracted groundwater would be treated via physical treatment, and distributed for irrigation use. If shown to be effective, natural attenuation would be used to address downgradient portions of the plume. If MNA is not shown to be effective, additional extraction and treatment would be implemented to achieve RAOs in the downgradient plume. Institutional controls would be provided to prevent exposure to basal groundwater impacted by site COCs and to prevent activities that might interfere with the effectiveness of the remedy. The effectiveness and progress of the remedy would be monitored using the existing Basal Well and existing regional monitoring wells as well as new wells that will be installed to characterize the plume, delineate the source, and monitor remedy performance. The well network would be sufficient to demonstrate effectiveness of source control and whether or not natural attenuation is effective. As a contingency, point-of-use treatment would be used if drinking water supplies were unexpectedly to become affected by Site COCs. Monitoring and institutional controls would be continued for a period of time after drinking water standards are reached to ensure that concentration levels are stable and remain below MCLs.

Modeling estimates indicate that the basal aquifer plume will disperse rapidly (on the order of 3 to 5 years) once source control is implemented. The major components of this alternative are:

- Installation of groundwater monitoring wells to characterize the source area and the downgradient plume and to monitor remedy performance
- Extraction of basal groundwater in the source area to eliminate the source of COCs.
- Treatment of extracted groundwater via air stripping and carbon adsorption.
- Implementation of a groundwater monitoring program to monitor the effectiveness of the remedies in the source area and downgradient plume.
- Increase pumping rate from the Kunia Well and/or other wells if needed to attain source control.
- Evaluation of data and consideration of the contingency for MNA.
- If MNA is proven to be effective, allow natural attenuation to reduce COC concentrations in the basal aquifer downgradient of the source area with performance monitoring.
- If MNA is proven to not be effective, implement additional pumping and treating of the downgradient plume with performance monitoring.

- Implementation of institutional controls to prevent exposure to basal groundwater impacted by COCs and to prevent activities that might interfere with the effectiveness of the remedy.

- Continuing institutional controls and monitoring for at least five years after groundwater cleanup levels have been achieved to ensure that concentration levels are stable and remain below MCLs.

Groundwater Extraction - Basal Aquifer

Groundwater extraction for the basal aquifer would initially be implemented in the source area and would be intended as hydraulic containment to prevent COCs that reach the basal aquifer from migrating outside of the source area. Based on a pump test conducted during the RI, sufficient hydraulic containment could be provided using only the Kunia Well pumping at 325 gpm. A higher groundwater extraction rate, although not expected to be required to achieve minimum hydraulic containment, would be beneficial in that it would decrease the time required for natural attenuation (by controlling a greater percentage of the plume). A pumping rate of 1,000 gpm from the Kunia Well has been assumed. Continuous pumping at this rate would result in 1.44 million gallons per day (mgd). The current water allocation is based on an annual average of 1.075 mgd. There will be some down time for well pumping over the course of a year such that the current water allocation would not be exceeded.

Additional groundwater extraction and treatment for the downgradient plume would be implemented if the contingent MNA is shown to not be effective. The design for additional groundwater controls would be optimized based on the additional data collected to characterize the plume and evaluate effectiveness of source control.

Treatment - Extracted Groundwater

Physical treatment would be used for treatment of extracted basal groundwater in both Alternative B2 and B3. Physical treatment would consist of air stripping followed by liquid phase carbon adsorption.

A packed tower air stripper would be used. A packed tower provides better air-water contact than a tray stripper, meaning more efficient removal. At the design flow rate, the higher removal efficiency and lower power requirements are significant.

Under State of Hawaii regulations, treatment of air emissions is not required for sources less than 0.1 tons/year of the COCs. It is expected that air emissions would not exceed this limit. However, if air monitoring shows that air emissions exceed 0.1 tons/year, then off-gas treatment would be provided using vapor-phase carbon adsorption.

Design assumptions for this remedy component are as follows:

- Influent groundwater rate: 1,000 gpm

- Influent EDB: 0.25 μg/L

- Effluent EDB: < 0.04 (MCL)

- Influent DBCP: 1.1 μg/L

- Effluent DBCP: < 0.04 (MCL)

- Off-gas treatment: Carbon adsorption (if needed)

The assumed influent concentrations are based on data collected during the RI, which are higher than concentrations in more recent sampling. Continuous operation was assumed for determining operation and maintenance cost.

Monitored Natural Attenuation

Monitored natural attenuation (MNA) is a contingent component of Alternative B2. Natural attenuation is monitored use of naturally occurring physical, chemical, and biological processes that act without human intervention, to reduce the toxicity, mass, mobility or concentration of COCs. These processes include biodegradation, dispersion, dilution, sorption, volatilization, and chemical transformation. For this site, the primary attenuation mechanism is believed to be dispersion with a possible small contribution from abiotic degradation (e.g., hydrolysis). Source control, a thorough characterization of the extent of the plume, and long-term performance monitoring are fundamental components of any MNA remedy. MNA will be used only when it is shown to meet groundwater cleanup objectives within a timeframe that is reasonable compared to pumping and treating the plume. It is estimated that cleanup objectives will be met within 3 to 5 years for both MNA and active remediation.

Natural attenuation differs from "no action" in that: (a) chemical concentration reductions occur in the groundwater plume in a manner which is protective of downgradient receptors; (b) the progress of remediation is monitored to ensure its effectiveness and progress, and; (c) institutional controls are used where applicable to ensure that unacceptable exposure does not occur while the remedy is in progress.

Monitored natural attenuation is included in this alternative as a contingency for the downgradient plume, if groundwater monitoring data demonstrate that it would be effective. Removal of the basal source via hydraulic containment allows a rapid reduction in the concentrations of COCs in the downgradient plume. Additional source control would be provided by perched aquifer remediation. Therefore, source control, via basal aquifer hydraulic containment and perched aquifer remediation, is an important component of Alternative B2 in the event contingent MNA is implemented.

Nearly 20 years of historical data at the Kunia Well and perched aquifer wells have shown a definite downward trend in basal and perched aquifer COC concentrations in the source area. This downward trend has resulted in about a 50% decline in DBCP concentrations and a decline of more than 90% for EDB at the Kunia Well since 1983. This information provides strong evidence that the source of contamination to the basal aquifer has been declining for some time.

The modeled maximum expected travel distances to an MCL exceedance were less than about 4500 feet from the KVA. These are worst-case predictions and the actual travel distances may be less. Active source control (i.e., pump-and-treat for the basal source area and/or perched aquifer remediation) will insure that further declines occur. Therefore, MNA for the downgradient plume in the basal aquifer will not likely result in additional migration of chemicals in the basal aquifer or unacceptable impacts to receptors. Additional site characterization and performance monitoring would be needed to demonstrate this.

Institutional Controls

Institutional controls (e.g., groundwater use restrictions) would prohibit certain activities unless such activities are first reviewed and approved by EPA. These prohibited activities include the following:

- Installation of groundwater extraction wells into the plume of contaminated groundwater or extraction of contaminated groundwater that will adversely impact the basal aquifer remedy;

- Installation of groundwater extraction wells or extraction of groundwater in proximity to the contaminated groundwater that causes movement of groundwater that would negatively affect the monitoring and/or extraction wells associated with the basal aquifer remedy, and

- Activities that would damage or interfere with the effectiveness of any component of the basal aquifer remedy.

Appropriate fencing would also be included to prevent access to groundwater extraction and treatment systems. Appropriate warning signs will also be put into place.

Monitoring

For the basal aquifer, monitoring will be needed to verify the effectiveness of source control and natural attenuation. The general program will consist of:

- Installing new wells to determine the direction of groundwater flow, plume boundaries and assess plume dissipation.

- Installing a new well or wells to define the extent of the source area. These wells will also be used as performance monitoring wells to evaluate the effectiveness of basal aquifer source control.

- Installing a point of compliance monitoring well at the leading edge of the plume. The point of compliance monitoring well will be used to help determine where the contingent MNA remedy can be implemented (see Section 11.1.2 for further discussion of point of compliance monitoring).

- Monitoring at regional basal wells to provide data on COC levels at the relevant existing supply wells (HCC well and Honouliuli II wells).

New wells will be installed using a phased approach, as discussed below:

- Two wells will be installed that, in conjunction with the existing Basal Well and Kunia Well, will be used primarily to determine groundwater flow direction in the basal aquifer. These well locations will be approximately 2,500 to 3,000 feet downgradient of the KVA. This distance is expected to be sufficiently far from the KVA that potential measurement errors will be minimized in relation to the expected head differences between wells. In addition to providing information related to flow direction, these wells, in conjunction with the structural discontinuity located between the Ewa-Kunia and Waiawa-Waipahu aquifers, will be useful in bounding the plume laterally from water quality data and plume symmetry considerations.

- A monitoring well (or wells) will also be installed to delineate the extent of the basal aquifer source area and to monitor performance of the source area containment system. These data will be used to demonstrate that hydraulic control has been achieved.

- Using data from new and existing wells to evaluate flow directions, monitoring wells will be installed in the downgradient flow path from the KVA. The locations will be evaluated based on a refinement of the groundwater plume model with new water quality data . One of the wells will be installed downgradient of the source area near the leading edge of contamination (see Section 11.1.2

for further discussion). This well will be used to confirm that COCs have not migrated farther downgradient than anticipated and that MNA is still a potential contingent option.

- If the new monitoring well data indicate that the groundwater flow direction is sufficiently different than anticipated and/or the downgradient plume MCL concentrations are not sufficiently bounded, an additional monitoring well (or wells) will be installed at a location based on further refinement of the groundwater plume model with newly acquired data.

- Further monitoring well installation would only be necessary if: (1) the downgradient MCL concentration limits of COPCs are not adequately bounded; or (2) there are no monitoring wells located in the plume emanating from the KVA with detectable concentrations to monitor attenuation.

Following completion of these wells, all the data will be evaluated to determine if the monitoring network is adequate to meet site monitoring objectives, or if an additional well or wells will be needed. In addition to monitoring at these new wells, monitoring would also be conducted at regional wells, including the HCC well, and one of the Honouliuli II wells. These will provide information of water quality and concentrations at key receptor locations, as well as to further confirm the results of modeling.

Remediation Timeframe

Modeling was conducted as part of this FS to estimate the timeframe required for MNA to attain RAOs for the basal aquifer. The modeling was based on the "reasonable worst case" analysis presented in the RI for the historically observed basal aquifer impacts. For the estimate the aim was to assess the impact of source control on the downgradient plume. The modeling indicates that source control is expected to result in a rapid dispersal of the downgradient plume. The maximum concentration along the centerline of the plume falls below the MCL after approximately 3 years time. Because this modeling was conducted using the reasonable worst-case scenario from the RI, this result is conservative. Use of the best estimates for the parameters would result in even shorter times. On the basis of these results, once source control is attained, MNA is projected to achieve basal aquifer RAOs in an estimated three to five years. This calculation demonstrates that RAOs could be achieved within a reasonable timeframe.

9.2.3 Alternative B3 – Groundwater Extraction and Treatment in the Source Area and the Downgradient Plume

This alternative involves containment and treatment of both the source area as well as the entire downgradient plume. A comprehensive groundwater investigation would be conducted to determine the dimensions of the source area and the downgradient plume to provide information required to design and implement an efficient extraction system. Additional monitoring wells would be installed to provide performance monitoring to determine the effectiveness of the system. The source area would be extracted and treated for use as irrigation water as described for Alternative B2. An extensive extraction well network would then be installed and an additional treatment system constructed to treat the extracted groundwater. Injection wells would be installed to re-inject treated water in excess of Del Monte’s water right.

The major components of this alternative are:

- Site characterization to delineate the source area and downgradient plume and design an extraction system.
- Extraction of basal groundwater in the source area to remove the source of COCs from the downgradient plume.
- Installation of groundwater extraction wells and treatment system and extraction of basal groundwater in the downgradient plume to accelerate meeting remediation goals in this plume.
- Treatment of extracted groundwater via air stripping and carbon adsorption.
- Discharge of treated water for irrigation to the extent allowed under Del Monte water rights (source area and possibly some downgradient basal groundwater).
- Reinjection of treated groundwater in excess of Del Monte water rights (i.e., from the downgradient plume).
- Implementation of institutional controls to prevent exposure to basal groundwater impacted by COCs and prevent activities that might interfere with the effectiveness of the remedy
- Continuing institutional controls and monitoring as long as basal groundwater quality exceeds remediation goals for the basal aquifer.

Groundwater Extraction - Basal Aquifer Source Area and Downgradient Plume

Groundwater extraction would be conducted for the entire area of the basal aquifer impacted above MCLs, both within and outside the source area (i.e., in the downgradient plume). The objective would be to provide containment of the downgradient plume and to accelerate groundwater cleanup through active remediation, without attempting to phase implementation of the groundwater extraction system. Additional investigation would still be required to fully characterize the downgradient plume to enable design and implementation of an efficient extraction well network. Following delineation of the MCL exceedance plume, extraction wells would be installed. It is assumed that several of the wells installed to define the plume could also be used for extraction or performance monitoring wells.

The assumed extraction system would include 5 wells. One line of 2 wells would be installed perpendicular to the flow axis across the widest section of the plume. A second line of 2 wells would be installed further downgradient across the flow path, and one well would be installed at the downgradient edge along the centerline of the plume. The goal would be to provide complete containment, limiting any additional migration, and also provide the optimum extraction efficiency and reliability (maintenance, downtime, etc.) for attaining RAOs for the entire plume in a short timeframe (three to five years, including time for characterization and construction).

The extracted water would be transported to the groundwater treatment system though pipelines. After treatment, any water in excess of Del Monte water rights would be re-injected back into the aquifer through a series of injection wells. Reinjection of the treated water would not affect the quantity of groundwater available for beneficial uses further downgradient, and may be required due to limits on withdrawals from the Ewa-Kunia aquifer system. It is anticipated that two injection wells would be installed in a line perpendicular to the flow axis. They would be located a sufficient distance downgradient of the extraction system to minimize hydraulic influences to extraction. Two wells are included to ensure that there is always one available in the event of maintenance. An Underground Injection Control permit from EPA or the HDOH may be needed for reinjection of treated water offsite.

Design assumptions for components of this remediation system are:

- Number of extraction wells: 4 in two lines plus 1 at plume end
- Total extraction rate: 5 wells at 250 gpm each = 1,250 gpm
- Number of reinjection wells: 2

Treatment - Extracted Groundwater

The design of groundwater treatment for the downgradient basal plume would be very similar to treatment for the basal source area (air stripping followed by liquid-phase carbon adsorption as described above in Alternative B2). The treatment system would be connected to the groundwater extraction and reinjection system. Design assumptions for this remediation component are as follows:

- Influent groundwater rate: 1,250 gpm
- Influent EDB: 0.02 to 0.2 μg/L
- Effluent EDB: Not detectable to < 0.04 (MCL)
- Influent DBCP: 0.02 to 0.9 μg/L
- Effluent DBCP: Not detectable to < 0.04 (MCL)
- Off-gas treatment: Carbon adsorption (if needed)

Influent concentrations are assumed to range from the quantitation limit to about the maximum concentrations detected in the Basal Well, although average concentrations would be expected to be lower than these maximum concentrations.

Institutional Controls

The Institutional Controls for this alternative are the same as described above for Alternative No. B2.

Monitoring

Performance monitoring wells (6 new wells were assumed in the FS) would consist of:

- Two types of source area wells- wells to delineate the plume in the source area and wells to monitor the effectiveness of source control from pumping at the Kunia Well (see Alternative B2 for further discussion of these monitoring wells);
- Plume delineation wells and new monitoring wells to monitor effectiveness of hydraulic containment of the downgradient contaminant plume.
- Wells located downgradient of the extraction well at the downgradient centerline of the plume.

Performance monitoring wells would be sampled for COCs and head measurements would be used to evaluate capture zones and optimize extraction well pumping to contain the plume while minimizing the volume of water extracted and treated.

Remediation Timeframe

The goal would be to provide complete containment, limiting any additional migration, and also provide the optimum extraction efficiency and reliability (maintenance, downtime, etc.) for attaining RAOs for the entire plume within three to five years after groundwater extraction begins.

10 Comparative Analysis of Alternatives

The six remedial alternatives described in Section 9 are evaluated using the nine Superfund evaluation criteria listed in 40 C.F.R. Section 300.430. The comparative analysis provides the basis for determining which alternatives present the best balance of the criteria. The first two evaluation criteria are considered threshold criteria that the selected remedial action must meet. The five primary balancing criteria are balanced to achieve the best overall solution. The two modifying criteria, state and community acceptance, are also considered in remedy selection.

Threshold Criteria

- **Overall Protection of Human Health and the Environment** addresses whether each alternative provides adequate protection of human health and the environment, and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled through treatment, engineering controls, and/or institutional controls.

- **Compliance with ARARs** addresses the requirement of Section 121(d) of CERCLA that remedial actions at least attain legally applicable or relevant and appropriate federal and state requirements, standards, criteria, and limitations, which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA Section 121(d)(4).

Primary Balancing Criteria

- **Long-term Effectiveness and Permanence** refers to the ability of a remedy to maintain reliable protection of human health and the environment over time.

- **Reduction of Toxicity, Mobility, or Volume Through Treatment** refers to the anticipated performance of the treatment technologies that may be included as part of a remedy.

- **Short-term Effectiveness** addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers and the community during construction and operation of the remedy until cleanup goals are achieved.

- **Implementability** addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered.

- **Cost** evaluates the estimated capital, operation and maintenance (O&M), and indirect costs of each alternative in comparison to other equally protective alternatives.

Modifying Criteria

- **State Acceptance** indicates whether the state agrees with, opposes, or has concerns about the preferred alternative.

- **Community Acceptance** includes determining which components of the alternatives interested persons in the community support, have reservations about, or oppose.

This section describes each threshold and primary balancing criterion, evaluates each alternative in relation to each criterion, and identifies advantages and disadvantages among the alternatives in relation to each criterion. Table 11a (perched aquifer alternatives) and 11b (basal aquifer alternatives) present a comparative matrix in which the three alternatives are ranked for each of the evaluation criterion. The details of how the rankings have been assigned for each criterion are provided below.

10.1 Overall Protection of Human Health and the Environment

The NCP requires that all alternatives be assessed to determine whether they can adequately protect human health and the environment from unacceptable risks from site contamination. These risks can be mitigated by eliminating, reducing, or controlling exposure to hazardous substances, pollutants, or contaminants.

Perched Aquifer Alternatives

Alternatives P2 and P3 provide adequate protection of human health and the environment. The No-Action alternative, Alternative P1, does not because it does not have an active remedy component that inhibits continued migration of contaminants into the basal aquifer. Alternative P1would increase the long-term potential for human exposure, because of continued loading of contaminants to the basal aquifer, a drinking water source. P2 and P3 both significantly reduce the migration of perched groundwater containing COCs keeping it from reaching the basal groundwater. The flux rates will be reduced such that within five to eight years they will not be able to cause MCL exceedances in the basal aquifer. Alternative P3 will result in additional long-term protection over that provided by P2 by using SVE to remove COCs from the dewatered saprolites. Short-term effectiveness of P3 is better than P2, because active remediation of the perched aquifer and deep soils can be completed faster with alternative P3.

Considered in conjunction with either basal aquifer Alternatives B2 or B3 (discussed below), both Alternatives P2 and P3 satisfy EPA's remedial action objectives and reduce long-term risks to human health and the environment by containing contaminated groundwater in the source area, removing contaminant mass and limiting the potential for exposure. The phytoremediation treatment technology to be employed by these alternatives appears to be effective at meeting federal and state MCLs. Alternative P3 is ranked higher than Alternative P2 because it includes additional contaminant removal in the source area using SVE.

Basal Aquifer Alternatives

Both Alternatives B2 and B3 provide adequate protection of human health and the environment by containing the basal aquifer source area and initiating remediation of the downgradient plume. The No-Action Alternative (B1) does not because there is no action taken to control the source area, allowing continued migration of contaminants into downgradient areas that contain drinking water wells. Alternatives B2 and B3 both provide long-term effectiveness and permanence and would allow RAOs to be reached in a short timeframe (3 to 5 years). Alternative B3 may achieve RAOs slightly faster than B2, if natural attenuation is not as effective as anticipated.

Alternatives B2 and B3 both satisfy EPA’s remedial action objectives and reduce long-term risks to human health and the environment by containing contaminated groundwater in the source area, containing and removing contaminant mass from the downgradient plume and reducing the potential for exposure by ensuring that the downgradient plume does not impact drinking water production wells. The two-stage, air stripping and liquid-phase carbon adsorption treatment process included in Alternatives B2 and B2 will be effective at meeting MCLs.

10.2 Compliance with ARARs

This evaluation criterion is also a threshold requirement and is used to determine if each alternative would attain federal and state ARARs, or whether there is adequate justification for invoking waivers for specific ARARs.

The No-Action Alternatives P1 and B1 do not meet ARARs. Both alternatives allow for continued migration of contaminants above MCLs toward downgradient drinking water wells and leave considerable untreated waste(i.e., contaminated groundwater) in the aquifer.

Alternatives P2, P3, B2, and B3 were designed to meet the ARARs described in Section 12 of this ROD. These alternatives provide containment of contaminated basal groundwater as well as protection of existing production wells.

10.3 Long-Term Effectiveness

This evaluation criterion assesses the extent to which each remedial alternative reduces risk after the remedial action objectives are met. Residual risk can result from exposure to untreated waste or treatment residuals. The magnitude of the risk depends on the magnitude of the wastes and the adequacy and reliability of controls, if any, that are used to manage untreated waste and treatment residuals. For this action, untreated waste refers to any contaminated groundwater not removed from the aquifer.

The performance of the alternatives in relation to this criterion is evaluated primarily by estimating the extent to which each alternative prevents the migration of contaminated groundwater and how quickly the remedy can reduce basal aquifer concentrations to below MCLs. Preventing or reducing contaminant migration reduces contaminant concentrations in downgradient areas, reducing risk by reducing the likelihood of exposure.

Perched Aquifer Alternatives

Alternative P3 would aggressively remove COCs from the perched aquifer by a combination of SVE and groundwater extraction and treatment. Use of SVE with groundwater pumping would allow shutdown of the active remediation systems much sooner. In contrast, although it would also remove some COC mass, Alternative P2 essentially relies on long-term hydraulic containment for its effectiveness. Groundwater pumping would be required indefinitely (for more than 30 years) because it is not capable of removing sufficient quantity of COCs mass in dewatered areas of the saprolite. Likewise, land use restrictions would have to be maintained for 30 years or more for Alternative P2 as compared to about eight years for Alternative P3. Alternative P1 would not achieve RAOs because it does not have an active remedy component that provides migration control or containment of the contaminated groundwater. Contaminated groundwater would continue to migrate downgradient and downgradient water supply wells would be vulnerable to COC contamination. Alternative P1 would not generate any treatment residuals. Using the phytoremediation , Alternatives P2 and P3 will both generate relatively small volumes of treatment residuals, primarily the vapor-phase carbon from treating the SVE system discharge.

Basal Aquifer Alternatives

Alternative B1 does not provide measures to ensure protection of human health and the environment (unlike the other alternatives). The other two alternatives (B2 and B3) would achieve RAOs.

Alternatives B2 and B3 would achieve the same endpoint, COCs below MCLs in the basal aquifer, upon completion of remedial action. Although less of the contaminated groundwater is actively contained in Alternative B2 compared to B3, MNA of the downgradient plume, in conjunction with source control, is likely to be effective and reliable. The performance of MNA would be verified by groundwater monitoring. Therefore, Alternative B2 has nearly the same long-term effectiveness and permanence as Alternative B3. Land use restrictions would be the same for Alternatives B2 and B3 and are not included with B1.

In Alternatives B2 and B3 the residual generated from treatment of contaminated groundwater would be spent granular activated carbon- both liquid phase and vapor phase. This spent granular activated carbon would be either disposed or reactivated offsite. The transportation and disposal/reactivation of this residual would be conducted in accordance with applicable regulations and would present minimal long-term risks because contaminants adsorbed to the granular activated carbon would be either destroyed during the reactivation process or effectively contained at permitted disposal facilities.

10.4 Reduction of Toxicity, Mobility, and Volume Through Treatment

This criterion addresses the preference, as stated in the NCP, for selecting remedial actions employing treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous substances as a principal element of the action. This preference is satisfied when treatment is used to reduce the principal threats at a site through destruction of toxic contaminants, reduction of total mass of toxic contaminants, irreversible reduction in contaminant mobility, or reduction of total volume of contaminated media.

This evaluation focuses on the following factors for each remedial alternative:

- Whether the alternative satisfies the statutory preference for treatment as a principal element
- The treatment process employed, including the amount of hazardous materials that will be destroyed or treated and the degree of expected reduction in toxicity, mobility, or volume
- The degree to which treatment is irreversible
- The type and quantity of treatment residuals that will remain following treatment.

Perched Aquifer Alternatives

Alternatives P2 and P3 both satisfy the statutory preference for treatment. These alternatives would significantly reduce the volume and mobility of contamination by inhibiting further contaminant migration down to the basal aquifer. The phytoremediation treatment technology contemplated for perched groundwater in Alternatives P2 and P3 would irreversibly reduce the toxicity and volume of contaminants in the extracted groundwater and result in an effluent stream that meets drinking water standards.

Alternative P3 provides the greatest reduction in volume of contaminant mass through treatment because SVE, with vapor-phase carbon treatment, is added to the groundwater treatment. Alternative P2 includes only the groundwater treatment. Alternative P1 does not provide any reduction in toxicity, mobility, or volume through treatment and does not satisfy the statutory preference for treatment.

Basal Aquifer Alternatives

Over the life of the remedy, Alternatives B2 and B3 would provide a similar reduction in contaminant volume and mobility. However, Alternative B3 would provide a greater amount of physical treatment (both the source and downgradient areas) and somewhat higher total COC mass removal than Alternative B2, the difference in mass removal is not significant. This is because Alternative B3 involves removal of a very large volume of only slightly impacted groundwater.

Alternative B2 provides the treatment for the source area but may not include it for the downgradient plume, if the contingent MNA is demonstrated to be effective. If additional pump-and-treat is determined to be necessary for Alternative B2, it would be optimized based on the additional site characterization data obtained. Alternative B1 does not provide treatment.

The treatment technologies considered for Alternatives B2 and B3, air stripping with off-gas controls and liquid-phase carbon adsorption, would irreversibly reduce the toxicity and volume of contaminants in the extracted groundwater and result in an effluent stream that meets drinking water standards. Both treatment technologies would result in the destruction of COCs if the granular activated carbon is regenerated.

10.5 Short-Term Effectiveness

This criterion evaluates the effects of each remedial alternative on human health and the environment during the construction and implementation phase until remedial action objectives are met. The following factors are addressed for each alternative:

- **Protection of workers and the community during construction and implementation phases.** This factor qualitatively examines risk that results from implementation of the proposed remedial action and the effectiveness and reliability of protective measures.
- **Environmental impacts.** This factor addresses the potential adverse environmental impacts that may result from the construction and implementation of an alternative. This factor also evaluates the reliability of the available mitigation measures to prevent or reduce potential impacts.
- **Time until RAOs are achieved.** This factor considers the amount of time required to construct remediation facilities and meet the remedial action objectives.

Perched Aquifer Alternatives

Alternative P1 is not evaluated for this criterion because there is no construction or implementation phase and RAOs would not be met. Alternative P3 would achieve RAOs and allow ceasing groundwater extraction and treatment in an estimated 8 years, making it the only perched aquifer alternative with a relatively short time to completion. Alternative P2 would require long-term (more than 30 years) operation, maintenance, land use restrictions, and monitoring to continue to achieve RAOs. Neither Alternative P2 or P3 pose unmitigable risks to the community or the environment during construction or implementation. The alternatives would involve the general construction hazards associated with any large construction project.

Basal Aquifer Alternatives

Alternative B1 is not evaluated for this criterion because there is no construction or implementation phase and RAOs would not be met. Alternatives B3 and B2 would take approximately the same amount of time to achieve RAOs in the basal source area. For the downgradient plume, Alternative B3 would likely achieve RAOs in the downgradient plume somewhat faster than Alternative B2. However, the time required for Alternative B3 to reach RAOs in the downgradient plume is dependent on the effectiveness of source control, the time required to characterize the plume adequately, and the time required to construct and implement the downgradient extraction and treatment system (after plume characterization). Modeling results indicate that, once source control is implemented, COC concentrations in the downgradient plume will be reduced rapidly through natural attenuation (estimated three to five years). Therefore, the time to achieve RAOs will not be substantially different for Alternatives B2 and B3.

Neither Alternative P2 or P3 pose unmitigable risks to the community or the environment during construction or implementation. The alternatives would involve the general construction hazards associated with any large construction project.

10.6 Implementability

This criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. The following factors are considered:

Technical Feasibility

- Ability to construct and operate: addresses any technical difficulties and unknowns associated with construction or operation of the technology
- Reliability of technology: focuses on the likelihood that technical problems associated with implementation will lead to schedule delays
- Ease of undertaking additional remedial action: includes a discussion of what, if any, future remedial actions may need to be undertaken and how the remedial action would interfere with, or facilitate, the implementation of future actions

Administrative Feasibility

- Coordination with other agencies, including the need for agreements with parties other than EPA required for construction and operation of the remedy.
- Availability of necessary equipment, specialists, and provisions to assure any necessary resources
- Availability of services and materials, plus the potential for obtaining competitive bids

Perched Aquifer Alternatives

Alternative P1 is not evaluated for this criterion because no action is implemented. As described above, the implementability evaluation incorporates several factors. Each of these is discussed separately in the following text.

Technical Feasibility: Ability to Construct and Operate. The capping, extraction, treatment, and monitoring technologies included in Alternatives P2 and P3 are all relatively straightforward to construct and operate. Much of the groundwater extraction, treatment and monitoring system has already been constructed and operated.

There are operational difficulties expected with operation of the SVE system included in Alternative P3 because of the clayey soils present in the perched aquifer.

Technical Feasibility: Reliability of Technology. The extraction, SVE, and monitoring technologies included in Alternatives P2 and P3 are proven and known to be reliable. The proposed phytoremediation treatment technology is an innovative technology that does have a proven record of long-term reliability in this particular application. However, extensive pilot-scale and full-scale testing of the technology for treatment of the extracted groundwater from the perched aquifer in the KVA has provided very favorable results.

Technical Feasibility: Ease of Undertaking Additional Remedial Actions. The alternatives would not interfere with the implementation of future response actions to further contain contamination or restore groundwater in the Del Monte Site area.

Administrative Feasibility. Implementation of Alternatives P2 and P3 require that institutional controls be established in the Kunia Village source area that will restrict land-use activities until the remedial action is completed. It may be more difficult to implement and maintain the land use restrictions for the 30 years or more that would be required for Alternative P2 compared to the 8 years for Alternative P3. Therefore, from an administrative feasibility perspective, Alternative P3 would be somewhat easier to implement that Alternative P2.

Availability of Services and Materials. Required services and materials are believed to be available for implementation of Alternatives P2 and P3, including qualified contractors for construction and operation of the necessary facilities.

Overall, Alternative P2 is ranked slightly higher than Alternative P3 for the implementability criterion.

Basal Aquifer Alternatives

Alternative B1 is not evaluated for this criterion because no action is implemented. As described above, the implementability evaluation incorporates several factors. Each of these is discussed separately in the following text.

Technical Feasibility: Ability to Construct and Operate. Alternative B2 requires construction and operation of a relatively large groundwater treatment system. However, because the Kunia Well and Basal Well are already installed, Alternative B2 could be implemented relatively quickly. In contrast, Alternative B3 would be more difficult to implement because it involves construction and operation of the additional downgradient extraction, conveyance and treatment system. Alternative B3 would most likely also require installation of a network of injection wells to return treated groundwater to the aquifer. Although the larger system in Alternative B3 will be more difficult to implement, there do not appear to be any significant technical issues that would inhibit construction or operation.

Technical Feasibility: Reliability of Technology. The extraction, treatment, and monitoring technologies included in Alternatives B2 and B3 are generally proven and known to be reliable. The reliability of the MNA component of Alternative B2 is not known at this point. Although MNA has proven to be effective and reliable at many sites, little information is available on the downgradient plume at the Del Monte Site to assess its reliability in this application.

Technical Feasibility: Ease of Undertaking Additional Remedial Actions. The alternatives would not interfere with the implementation of future response actions, if necessary, to restore groundwater in the Del Monte Site area. As a contingency measure, monitoring wells installed in the downgradient plume during site characterization will be constructed to allow them to be used as potential future extraction wells, if necessary.

Administrative Feasibility. Alternatives B2 and B3 both require that institutional controls be in place during implementation of the remedial action to prevent activities that might interfere with the effectiveness of the remedy. There is some uncertainty regarding the ease with which adequate land use controls can be obtained. The land use restrictions would be the same for both alternatives and would therefore involve the same degree of difficulty to implement.

In addition, implementing Alternative B3, and potentially Alternative B2, may require resolution of administrative issues associated with groundwater extraction in excess of Del Monte's allocation and re-injection of treated groundwater back into the aquifer.

Availability of Services and Materials. Required services and materials are believed to be available, including qualified contractors for construction and operation of the necessary facilities.

Overall, Alternative B3 would be the somewhat more difficult to implement than Alternative B2. It involves construction and operation of a source-area treatment system (the same as Alternative B2), plus detailed characterization of the downgradient groundwater plume, followed by construction of a very large extraction and treatment system (much larger than the source area system).

10.7 Cost

This criterion addresses the total cost of each alternative. This includes short-term and long-term costs, and capital and O&M costs. The following cost elements are considered for each alternative:

- **Capital Cost.** Direct capital cost includes the cost of construction, labor, equipment, land, site development, and service. Indirect capital cost includes engineering fees, license and permit cost, startup and shakedown costs, and contingencies.
- **O&M Cost.** Annual O&M cost includes operating labor cost, maintenance materials and labor, pumping and treatment energy costs, monitoring costs, and all other post-construction costs necessary to ensure continuous effective operation of the alternative.
- **Total Present Worth.** The total present worth of each alternative is calculated at a discount rate of 5 percent and a maximum time period of 30 years. Total present worth for each alternative includes capital cost plus the present worth of the annual O&M costs.

The cost estimates are considered order-of-magnitude level estimates (i.e., the cost estimates have an expected accuracy of +50 to -30 percent).

Although there is no cost presented for the no-action alternatives (Alternatives P1 and B1), there is a potential substantial financial impact to downgradient water purveyors if the continued migration of contamination impacts their production wells. Table 12 summarizes the estimated costs for Alternatives B2, B3, P2, andP3.

Table 12 compares the cost of each alternative for capital costs, long-term O&M costs, and present worth. The short-term capital costs for perched aquifer alternatives are $720,000 for Alternative B2 and $1,460,000 for Alternative P3. For basal aquifer alternatives, the Alternative B2 capital cost is approximately $4,270,000 and Alternative B3 $8,730,000. The net present worth of the annual O&M costs are $1,360,000 for Alternative B2 and $1,590,000 for Alternative B3. For the basal aquifer alternatives, the present worth of the annual O&M is $5,580,000 for Alternative B2 and $9,170,000 for Alternative B3. The total present worth of the four alternatives range from a low of $2,100,000 for Alternative P2 to $17,900,000 for Alternative B3.

10.8 State Acceptance

In a letter dated September 22, 2003, the Hawaii State Department of Health, as lead agency for the state, concurred with EPA's selected remedy.

10.9 Community Acceptance

EPA received one written comment on the Proposed Plan. The pertinent oral comments from the public meeting held on April 2, 2003 and all of the written comments received during the 30-day public comment period, along with EPA's responses to them, are presented in the Responsiveness Summary in Part III of this ROD. The transcript for the public meeting is available at EPA's Superfund Records Center at EPA's Regional Office in San Francisco, and locally at the Del Monte Site Information Repository at the Wahiawa Public Library. None of the oral or written comments received warranted a change to the proposed remedy.

11 Selected Remedy

After considering CERCLA's statutory requirements, the detailed comparison of the alternatives using the nine evaluation criteria, and public comments, EPA, in consultation with the State of Hawaii, has determined that the most appropriate remedy for this site is Alternative P3 - Groundwater Extraction and Treatment with Capping and SVE for the perched aquifer and Alternative B2 - Phased Pump and Treat with Contingent Monitored Natural Attenuation for the basal aquifer.

Summary of Rationale for the Selected Remedy

Perched Aquifer

No-Action Alternative P1 provides the least overall protection of human health and the environment and does not fully comply with State and Federal requirements (ARARs). Considered in conjunction with the basal aquifer alternatives, Alternatives P2 and P3 both satisfy the RAOs and satisfactorily meet the threshold criteria of overall protection of human health and the environment and compliance with State and Federal requirements. Alternatives P2 and P3 both address containment of the perched aquifer source area. The perched aquifer source area contains considerable mass of COCs and is continuing to contribute contamination to the basal aquifer. EPA considers controlling migration out of the perched aquifer and removing this source as critical. Estimates indicate that Alternative P3 would achieve perched aquifer RAOs and allow ceasing groundwater extraction and treatment in an estimated eight years. In contrast, Alternative P2 would likely require long-term (more than 30 years) operation, maintenance, land use restrictions, and monitoring to continue to achieve RAOs.

EPA has designated contaminated deep soil (below 20 feet) in the Kunia Village source area as a principal threat waste at the site. This designation is based on the deep soil source material containing significant concentrations of highly toxic materials that have been shown to be mobile in the subsurface and that represent a significant risk to human health or the environment should exposure occur. It should be noted that the depth of these source materials (greater than 20 feet bgs) makes human exposure very unlikely, however the contaminated soil does represent a substantial threat to groundwater resources. Alternative P3 satisfies the preference in the NCP that EPA address principal threats wherever practicable (NCP Section 300.430(a)(1)(iii)(A)).

The principal threat waste will be addressed through dewatering (groundwater extraction), then extraction and treatment of the contaminants using the SVE system. In addition, the cap to be installed over the source area will minimize potential transport of contaminants away from the principal threat waste by reducing infiltration. Institutional controls plus access restrictions (fences and signage) will minimize potential exposure to the principal threat waste and ensure that nothing interferes with implementation of the remedy.

Basal Aquifer

No-Action Alternative B1 provides the least overall protection of human health and the environment and does not fully comply with State and Federal requirements (ARARs). Alternatives B2 and B3 both satisfy the RAOs and satisfactorily meet the threshold criteria of overall protection of human health and the environment and compliance with State and Federal requirements. Alternatives B2 and B3 both address remediation of the basal aquifer, in the source area and downgradient. The basal aquifer is used as a source of drinking water downgradient of the KVA and remediation of the basal aquifer is a high priority. Alternative B3 could potentially achieve RAOs slightly more quickly than Alternative B2, but Alternative B3 would be much more expensive than Alternative B2 (see Table 12) for very limited additional benefit. Also, there may be additional implementability issues in trying to build and operate the more extensive groundwater extraction and treatment system in the downgradient plume.

The selected remedy, Alternatives P3 and B2, meets the two Superfund threshold evaluation criteria, overall protection of human health and the environment and compliance with ARARs, and provides the best balance of the remaining Superfund evaluation criteria.

11.1 Description of the Selected Remedy

The selected remedy will be implemented using a performance-based approach. The performance-based approach specifies criteria (“performance criteria”) that must be met while allowing flexibility in implementation. The performance criteria described below are designed to attain the RAOs for the Del Monte Site. EPA's RAOs for the selected remedy are to:

- Prevent exposure of the public to groundwater contaminated in excess of MCLs (as is noted above in Section 8 and reiterated in Table 13, EPA has selected State of Hawaii MCLs as the chemical-specific cleanup standards for the basal aquifer for EDB, DBCP and TCP since they are lower than the Federal MCLs. EPA has selected the Federal MCL as the chemical specific cleanup standard for DCP for the basal aquifer).
- Minimize further migration of contamination away from the KVA;
- Limit migration of KVA perched groundwater and deep soil contaminants into the basal groundwater such that basal groundwater concentrations do not exceed MCLs, and;
- Restore groundwater to its beneficial use of drinking water supply within a reasonable timeframe.

The selected remedy addresses the perched aquifer and deep soils in the KVA and the basal aquifer. For purposes of describing the remedy, the basal aquifer has been separated into two areas: 1) the Kunia Village Area or the source area and 2) the downgradient plume.

Actual technologies and sequence of technologies used will be determined during remedial design. Minor modifications of the remedy may occur during remedial design. However, public notice would be given by EPA if there were any significant changes to the remedy and any fundamental changes would be subject to public comment.

11.1.1 Perched Aquifer Remedy

The perched aquifer remedy includes pit backfill (already completed), soil capping, SVE, groundwater extraction, groundwater treatment, institutional controls, and monitoring. The major components of this alternative are:

- Backfilling the pit (already completed).
- Construction of a vegetated soil cover, including appropriate storm water controls, over the perched aquifer source area. A soil cover would consist of a minimum of 30 inches of clean compacted soil fill overlain by 6 inches of vegetated topsoil. Maintenance of the vegetated soil cover would continue for as long as groundwater monitoring is continuing.
- Installation of an SVE system in the perched aquifer source area to remove contaminant mass from the deep soil (a principal threat waste) and reduce perched aquifer impacts on the basal aquifer. Treatment of the extracted soil vapor via carbon adsorption.
- Installation of a groundwater extraction system to provide hydraulic containment and active dewatering of the perched aquifer source area. Treatment of the extracted groundwater via phytoremediation. If phytoremediation is proven to not be effective, implement physical treatment.

- Implementation of institutional controls to prevent exposure to perched aquifer soil and groundwater that is impacted by COCs and to prevent activities that might interfere with the effectiveness of the remedy. Specific institutional controls are expected to include: 1) site access restrictions for all components of the perched aquifer remedy (e.g., fences with locked gates and warning signs), 2) a binding agreement between EPA and the owner of the Kunia Section of the Site providing for notice in the deed of the deep soil and groundwater contamination, and 3) governmental controls including well permitting requirements. Maintenance of institutional controls will continue until remediation goals are achieved and post operation monitoring is complete.
- Operation of the groundwater extraction and SVE systems until the perched aquifer contamination is reduced such that it can no longer cause exceedances of MCLs in the basal aquifer.
- Monitoring groundwater and soil vapor until remediation goals are achieved.

The perched aquifer source area refers to the portion of the perched aquifer in the Kunia Village area where concentration of COCs in groundwater exceed 1 µg/L. Based on the data collected during the RI and post RI field investigations, the boundaries of the perched aquifer source area are illustrated on Figures 7, 8 and 9, as the areas exceeding 1µg/L. However, there are still areas where the location of the 1 µg/L contour is uncertain. Additional perched aquifer investigations will be performed during remedial design to complete the delineation of the source area and to conduct an SVE pilot test. Based on the additional data collected during remedial design, EPA may modify the boundaries of the perched aquifer source area.

Soil Cap Performance Criteria

- The soil cap shall extend laterally across the entire perched aquifer source area.
- The soil cap shall, at a minimum, consist of an 30-inch thick compacted fill layer constructed from available clean cover soil material, overlain by 6 inches of top soil.
- The grading and stormwater controls shall be sufficient to ensure that standing water does not accumulate on the vegetated soil cover.
- The vegetation selected for the soil cap shall be similar to existing vegetation in the area and require minimal irrigation.

Compliance with Soil Cap Performance Criteria

Compliance will initially be demonstrated during construction by ensuring that the cap meets the minimum thickness criteria presented above.

As part of long-term O&M, visual monitoring will be conducted routinely to verify the continued integrity of the cap, including observing the status of site fencing and signage, confirming that standing water is not present on the cap, and monitoring for excessive erosion of the cap. The details of the long-term compliance monitoring will be described in a Compliance Monitoring Plan, submitted for EPA approval during remedial design.

Soil Vapor Extraction (SVE) Performance Criteria

The SVE system shall remove contaminant mass from the perched aquifer source area unsaturated zone starting at 20 feet below ground surface by exerting a pressure influence across the entire source area.

The SVE system in the perched aquifer source area will operate until the COC mass in soil has been reduced such that the source-area contamination no longer would result in exceedances of MCLs in basal aquifer groundwater. This will require that DBCP mass be reduced by 95 percent and EDB and DCP mass reduced by 75 percent (DCP has not yet exceeded MCLs in the basal aquifer and the 75 percent removal rate is expected to be sufficient to ensure long-term protection of the basal aquifer). The initial mass estimated during the RI/FS is 28 kilograms (kg) of DBCP and 11 kg of EDB. An initial mass estimate for DCP was not developed during the RI/FS. Based on the RI/FS data and soil vapor and soil data collected during remedial design, EPA will develop a DCP initial mass estimate and will reevaluate the initial mass estimates for DBCP and EDB. EPA may further revise the mass estimates based on soil vapor collected during remedy implementation.

The SVE system shall be designed with enough extraction wells and a high enough extraction rate to produce a contaminant mass removal rate sufficient to reach the mass removal goals within 8 years (in conjunction with the perched aquifer groundwater extraction system). If warranted, EPA may extend this target remediation timeframe based on SVE performance data collected from the SVE treatability study to be conducted during remedial design or during implementation of the remedy.

In addition, the SVE system shall operate as long as the basal aquifer source area extraction system is operating, including any resumption of extraction caused by MCL exceedances during the post-operation monitoring period (described below in Section 11.1.2).

During implementation of the remedy, if SVE and perched aquifer groundwater extraction system (described below) operational data indicate that mass removal rates have dropped substantially such that the system is no longer effectively removing contaminant mass (and mass removal rates do not improve after attempting a pulse-style operating mode), EPA may shutdown the system before the mass removal targets have been reached. However, the status of the basal aquifer source area groundwater action will be evaluated before early shutdown of the perched aquifer systems (SVE and groundwater) will be considered.

The SVE vapor treatment system must comply with all of the ARARs for air emissions described in Section 12. In addition, the treatment unit shall attain a minimum removal efficiency of 80 percent for each COC.

Any liquids generated by the SVE system shall be added to the perched aquifer extracted groundwater and treated using the phytoremediation system.

Compliance with SVE Performance Criteria

Pressure measurements will be performed at extraction wells and monitoring points throughout the source area to demonstrate compliance. In addition, annual evaluations will be performed of both the total mass removed and the percentage of the initial mass that has been removed for each COC. Data points to be used to demonstrate inward pressure gradients throughout the source area and the processes to be used to estimate mass removal rates and volumes will be defined during remedial design.

The treatment unit influent and effluent vapor quality will be monitored to ensure compliance with ARARs and the minimum removal efficiency requirements described above.

Perched Aquifer Groundwater Extraction Performance Criteria

The perched groundwater phytoremediation treatment system shall be a closed loop system with no discharge of the extracted groundwater through either subsurface infiltration or subsurface discharge.

The groundwater extraction system shall inhibit downward migration of groundwater from the perched aquifer source area to the basal aquifer throughout the source area by hydraulic containment or dewatering.

Similar to the SVE system, the groundwater extraction system in the perched aquifer source area will operate until the COC mass in soil and groundwater has been reduced such that the source area contamination no longer would result in exceedances of MCLs in basal aquifer groundwater. This will require that DBCP mass be reduced by 95 percent and EDB and DCP mass reduced by 75 percent. For DBCP and EDB, these percent reductions were calculated in the FS based on the magnitude of drinking water standard exceedances detected in the Kunia Well, located in the basal aquifer source area (as is noted above in the SVE discussion, DCP has not yet exceeded its MCL in the basal aquifer and the 75 percent removal rate is expected to be sufficient to ensure long-term protection of the basal aquifer). For example, DBCP was detected at approximately 20 times the drinking water standard (or MCL), so the perched aquifer source area concentrations need to be reduced by 95 percent (20 times) to bring the basal aquifer concentrations down to below drinking water standards.

For this ROD, mass reduction will be used as the performance standard, rather than a reduction in concentration. The mass estimated during the RI/FS is 28 kg of DBCP and 11 kg of EDB. An initial mass estimate for DCP was not developed during the RI/FS. Based on the RI/FS data and soil vapor and soil data collected during remedial design, EPA will develop a DCP initial mass estimate and will reevaluate the initial mass estimates for DBCP and EDB. EPA may further revise these mass estimates based on soil vapor and soil data collected during remedy implementation.

In addition, the perched aquifer groundwater extraction system shall operate as long as the basal aquifer source area extraction system is operating, including any resumption of basal aquifer extraction caused by MCL exceedances during the post-operation monitoring period.

As is noted above in the SVE discussion, if the combined perched aquifer groundwater/SVE system operational data indicate that mass removal rates have dropped substantially such that the system is no longer effectively removing contaminant mass (and mass removal rates do not improve after attempting a pulse-style operating mode), EPA may shutdown the systems before the mass removal targets have been reached. However, the status of the basal aquifer source area groundwater action will be evaluated before early shutdown of the perched aquifer systems will be considered.

Compliance with Perched Groundwater Extraction Performance Criteria

Water level measurements will be collected from extraction wells and monitoring points throughout the source area to demonstrate compliance with the hydraulic control/dewatering requirement. Annual evaluations will be performed of both the total mass removed and the percentage of the initial mass that has been removed for each COC. The data points to be used to demonstrate hydraulic control (e.g., inward gradients) throughout the source area and the processes to be used to estimate mass removal rates and volumes will be defined during remedial design.

The phytoremediation treatment system shall undergo routine visual monitoring to ensure that no leaks are occurring from the system. In addition, a water balance for the treatment unit shall be developed and tracked to ensure that all water can be accounted for, thus minimizing the potential for undetected subsurface leaks from the system.

Perched Aquifer Institutional Controls Performance Criteria

1) To provide notification of the presence of hazardous substances.

2) To minimize the potential for exposure to contaminated soils and groundwater.

3) To prevent activities that might damage or affect the integrity of either the cap or the phytoremediation cells.

4) To prevent damage or interference with groundwater monitoring or extraction wells associated with the perched aquifer remedy.

5) To prevent any activities that might interfere with the effectiveness of the remedy.

6) To prevent development of the Kunia Village source area for commercial, industrial, or residential use until remediation and post-operation monitoring is complete so as to protect the public from exposure to contaminated soil and groundwater.

Compliance with Perched Aquifer Institutional Control Performance Criteria

Routine site monitoring shall be performed to ensure that site access restrictions remain in effect and to ensure that there has been no damage or adverse affect upon any component of the perched aquifer remedy.

: Land use restrictions shall be put in place requiring the following:

- The owner must give notice of all institutional controls to any lessees of any portion of the Site.
- The owner must give 6 months prior notice to EPA before any sale of any portion of the Site.
- The owner must identify to EPA all lessees on any portion of the Site within 30 days of such lessees occupying any portion of the Site.
- Without prior review and written approval by EPA, the owner of the Kunia Section of the Site shall not undertake or allow any activities which: damage or affect the integrity of the cap; damage or affect the integrity of the phytoremediation cells; damage or interfere with the groundwater monitoring or extraction wells; or excavate or disturb contaminated soil.
- To ensure that the public is protected from exposure to contaminated soil and groundwater, the owner of the Kunia Section of the site shall not allow development of the Kunia Village source area for commercial, industrial, or residential use until remediation and post-operation monitoring is complete or until EPA agrees that such development will not cause a threat to public health.

11.1.2 Basal Aquifer Remedy

The basal aquifer remedy is groundwater extraction and treatment with contingent monitored natural attenuation. The remedy includes installation of monitoring wells to characterize the source area and downgradient plume; source area groundwater extraction, treatment and discharge; and downgradient plume monitoring to determine if natural attenuation is effective at reducing COC concentrations to MCLs. If monitoring data shows that natural attenuation is not effective at reducing contaminant concentrations to MCLs within 5 years, then additional groundwater extraction will be implemented to insure that the entire plume is captured and treated.

As an additional contingency, point-of-use treatment at downgradient drinking water wells will be implemented if the wells become impacted by contaminants from the site. Finally, the remedy includes Institutional Controls to insure that land use is restricted to prevent activities that might interfere with the effectiveness of the remedy and to prevent the installation of drinking water supply wells in the plume. Major components of the selected remedy are:

- Installation of monitoring wells to characterize the extent of contaminated groundwater in both the source area and the downgradient plume.
- Extraction of basal groundwater in the Kunia Village source area to provide hydraulic containment of the source area and eliminate the source of COCs to the downgradient plume. The extraction system will operate until the basal aquifer source area contamination is reduced to below MCLs and the perched aquifer remedy is complete.
- Treatment of extracted groundwater via air stripping and liquid-phase carbon adsorption, followed by discharge of the treated water for irrigation use.
- Evaluation of whether natural attenuation is acting to reduce contaminant concentrations in the downgradient plume.
- Potentially, contingent monitored natural attenuation to address the basal aquifer downgradient plume. The criteria that will be used to trigger implementation of the monitored natural attenuation action are described below.
- Potentially, groundwater extraction and treatment to address the basal aquifer downgradient plume. The criteria that will be used to trigger implementation of extraction and treatment are described below.
- Implementation of a monitoring program sufficient to monitor the effectiveness of source control and either natural attenuation of or extraction from the downgradient plume. Monitoring will continue for at least 5 years after cleanup standards are reached to ensure that the concentrations are stable and remain below the cleanup standards.
- Implementation of institutional controls to prevent exposure to basal groundwater impacted by COCs and to prevent activities that might interfere with the effectiveness of the remedy while the groundwater cleanup is progressing. Specific institutional controls are expected to include: 1) site access restrictions for all components of the basal aquifer remedy (e.g., fences with locked gates and warning signs), 2) a binding agreement between EPA and the owner of the Kunia Section of the Site providing for notice in the deed of the groundwater contamination, and 3) governmental controls including both groundwater use restrictions and well permitting requirements.
- Potentially, contingent installation of point-of-use treatment at downgradient drinking water supply wells in the event they become impacted by contaminants from the Del Monte Site.

The basal aquifer source area refers to the extent of basal aquifer contamination that is located vertically beneath the perched aquifer source area (described above in Section 11.1.1), plus a buffer zone of 25 percent beyond the perched aquifer source area boundary. This buffer zone is intended to account for the lateral spread of contamination as it travels downward from the perched aquifer to the basal aquifer. This 25 percent buffer applies around the entire perched aquifer source area because the lateral spreading during downward migration could be in any direction. As an example, if the east-west width of the perched aquifer source area is 400 feet, the basal aquifer source boundary would extend 100 feet beyond the eastern and western boundaries of the perched aquifer source area boundary. As is described in detail in Section 11.1.1, the boundary of the perched aquifer source area has not yet been defined in all directions. EPA will determine the final boundaries of the perched aquifer and basal aquifer source areas during remedial design.

Basal Aquifer Source Area Groundwater Extraction Performance Criteria

The remedial action shall provide sufficient hydraulic control to prevent further lateral and vertical migration of groundwater contaminated above MCLs out of the basal aquifer source area.

Implementation of the basal aquifer source area extraction will be phased. At a minimum, the first phase will include extraction from the Kunia Well. Groundwater monitoring during phase one will provide data on the performance of groundwater extraction from the Kunia Well. EPA will use these data, in conjunction with the final basal aquifer source area boundaries to determine whether additional extraction is required.

The basal aquifer source area groundwater extraction system will operate until the COC concentrations are below MCLs (Table 13). Basal aquifer source area monitoring must continue for at least five years after extraction has stopped to monitor for potential rebounds in contaminant concentrations. In addition, basal aquifer source area monitoring must continue for at least five years after the perched aquifer remedy has met its remediation goals. If MCL exceedances are detected at any time during basal aquifer source area monitoring, groundwater extraction from the basal aquifer source area will resume.

<u>Compliance with Basal Aquifer Source Area Groundwater Extraction Performance Criteria</u>

Demonstration of hydraulic control (i.e., inward gradients) must be used to demonstrate that the groundwater extraction is controlling lateral and vertical migration of contaminated groundwater out of the basal aquifer source area. Hydraulic control must be demonstrated throughout the basal aquifer source area.

COC concentrations in water extracted from the basal aquifer source area will be monitored to track the progress of source area cleanup.

Basal Aquifer Downgradient Plume - Phased Implementation Approach and Performance Criteria

The ultimate objective for the basal aquifer portion of the remedial action is to restore the basal aquifer to its beneficial use. The beneficial use of the basal aquifer is as a source of drinking water and the aquifer is currently used for this purpose downgradient of the Del Monte Site. Based on the information gathered to date, EPA believes that the selected remedy will achieve this objective in a reasonable timeframe.

The downgradient plume portion of the basal aquifer remedy will be implemented in two phases. Phase 1 will include installation of monitoring wells to determine groundwater flow direction and the extent of the basal aquifer downgradient plume, plus evaluation of monitoring data to assess the effectiveness of MNA. Phase 2 will include either implementation of the MNA contingency or implementation of downgradient groundwater extraction and treatment if MNA is not effective. The basal aquifer downgradient plume refers to the area exceeding MCLs downgradient of the source area boundary. There are currently no monitoring wells in the basal aquifer to define the extent of contamination downgradient of the Kunia Village area. During phase one, a sufficient number of monitoring wells will be installed (or existing wells identified) and monitored to achieve the following objectives: 1) determine the downgradient and lateral extent of the basal aquifer source area; 2) determine groundwater flow direction downgradient of the basal aquifer source area; 3) delineate the downgradient extent of cleanup standard exceedances in the basal aquifer; 4) track the distribution of contamination between the source area and leading edge of the plume; 5) monitor the leading edge of basal aquifer contamination to ensure that no exceedances of cleanup standards occur; and, 6) monitor upgradient of the nearest downgradient drinking water wells to provide early warning of potential impacts to the drinking water wells. The well (or wells) installed downgradient of the leading edge of contamination will be used as a point of compliance monitoring well. Monitoring wells located within the basal aquifer plume downgradient of the source area are termed performance monitoring wells and will be used to provide information for objectives 1, 3, and 4. Monitoring wells located upgradient of drinking water wells (objective 5) are termed sentinel wells. If properly located, a monitoring well may serve two purposes (e.g., the point of compliance well could potentially also serve as a sentinel well).

The leading edge of the downgradient basal aquifer plume is expected to be no more than 4,500 feet downgradient of the Kunia Village source area (Figure 10). Based on modeling conducted as part of the RI/FS, this distance represents the furthest distance downgradient from the source area that groundwater exceeding MCLs could migrate using "worst-case" assumptions. At least one monitoring well will be installed downgradient of the source area near this predicted maximum migration distance. If this initial point of compliance well indicates that cleanup standards are already exceeded at the 4,500 foot downgradient point, EPA will either require a replacement point of compliance monitoring well located further downgradient or determine that the MNA contingency is not appropriate. The MNA contingency will not be appropriate if the basal aquifer source area extraction system is operational, the leading edge concentrations are high, and insufficient time exists to determine that MNA is effective before a drinking water well would be impacted.

Once the downgradient extent of the plume has been established and a point of compliance monitoring point installed, if a verified MCL exceedance occurs at this point of compliance well, EPA may require that the basal aquifer downgradient plume extraction and treatment action (described below) be implemented.

After construction of the phase one monitoring system is complete, routine quarterly monitoring will be conducted to evaluate the downgradient plume and to monitor performance of source control. If no exceedances are detected at the point of compliance monitoring well, monitoring during phase one will be conducted for three years to ensure that sufficient information is available to select phase two of the remedial action. A three year timeframe was selected because MNA has been predicted to achieve cleanup in three to five years. Accordingly, there should be substantial evidence of the performance of MNA within three years.

If there is sufficient evidence to suggest that natural attenuation, in conjunction with containment of the source area, can be effective at reducing COC concentrations to MCLs in a reasonable timeframe, phase two will include implementation of contingent monitored natural attenuation. If the data collected during phase one indicate that natural attenuation will not be effective, phase two will include groundwater extraction and treatment for the basal aquifer downgradient plume. Performance criteria for both of the phase two options are described below.

Basal Aquifer Monitored Natural Attenuation Performance Criteria (if implemented)

The performance standards for the potential monitored natural attenuation component of the remedy require that COC concentrations throughout the downgradient plume must be reduced to below cleanup standards within 5 years of establishing containment of the basal aquifer source area (5 years is selected because the remediation timeframe estimates from the FS indicate that MNA should reduce COC concentrations to below drinking water standards within 3 to 5 years after source control is achieved) and that groundwater exceeding cleanup standards must not migrate beyond the point of compliance monitoring well (described above).

During phase one, performance monitoring wells will be installed upgradient of the leading edge of contamination (expected to be less than 4,500 feet downgradient) to help define the current extent of the downgradient plume and to provide data for evaluating whether the natural attenuation is progressing as expected. Progressing as expected means that the plume is stable, downgradient concentrations are decreasing and all cleanup standards will be met within 5 years of containing the source area. The progress of natural attenuation will be evaluated annually.

Compliance with Basal Aquifer Monitored Natural Attenuation Performance Criteria

Compliance with the performance criteria will be confirmed by quarterly groundwater sampling at the downgradient performance, point of compliance and sentinel monitoring wells.

Compliance with the 5-year cleanup requirement will be based on an annual technical evaluation of the progress of natural attenuation.

Basal Aquifer Downgradient Plume Groundwater Extraction Performance Criteria (if implemented)

If implemented, the downgradient plume groundwater extraction action will include groundwater extraction in the downgradient plume, groundwater treatment and discharge of treated water.

EPA will determine the location and magnitude of groundwater extraction required based on groundwater conditions at the time the phase two action is selected. The groundwater extraction implemented as part of a phase two action must be sufficient to ensure that groundwater cleanup standards are not exceeded at a point of compliance. EPA will identify the point of compliance at the time a phase two groundwater extraction action is selected. The point of compliance will be located downgradient of the leading edge of the downgradient basal aquifer plume.

The groundwater treatment performance criteria are described below . The treated water shall either be discharged for irrigation use by Del Monte or, if the volumes exceed irrigation requirements or water rights, the treated water shall be injected back into the basal aquifer downgradient of the point of compliance.

Compliance with Basal Aquifer Downgradient Plume Groundwater Extraction Remedy Performance Criteria (if implemented)

Compliance with the performance criteria will be determined through demonstration of hydraulic control (i.e., inward lateral and vertical gradients) at the leading edge of the downgradient plume.

The potential phase two groundwater extraction system shall operate until concentrations throughout the downgradient plume are below MCLs.

The annual report will document that all treated water was either used for irrigation or injected in the aquifer in accordance with ARARs.

Basal Aquifer Groundwater Treatment Performance Criteria

COCs will be removed to below MCLs from the extracted basal aquifer groundwater by air stripping and liquid-phase carbon adsorption. If necessary to comply with ARARs, the air-stripping off-gas will be treated with vapor-phase carbon adsorption. However, because of the relatively low COC concentrations in the basal aquifer, it is likely that off-gas controls will not be necessary to meet ARARs. If alternative treatment technologies are identified instead of air stripping and carbon adsorption, EPA will evaluate the alternative technology during remedial design using the same nine Superfund evaluation criteria employed to evaluate remedial alternatives (as described in Section 10 above and in 40 C.F.R. Section 300.430).

The groundwater treatment plant shall meet the effluent discharge standards, which are MCLs (Table 13), on a continuous basis.

Compliance with Basal Aquifer Groundwater Treatment Performance Criteria

COC concentrations will be monitored in the treatment unit effluent.

Basal Aquifer Institutional Controls Performance Criteria

1) To provide notification of the presence of hazardous substances.

2) To minimize the potential for exposure to contaminated groundwater.

3) To prevent damage or interference with any components of the basal aquifer remedy.

4) To prevent any change in the current use of the land, i.e., from pineapple farming, to commercial, other industrial, or residential use, until phase two of the downgradient plume portion of the basal aquifer remedy has been implemented and post-operation monitoring is complete.

Compliance with Basal Aquifer Institutional Control Performance Criteria

Routine site monitoring shall be performed to ensure: 1) that site access restrictions remain in effect, 2) that there has been no damage to any component associated with the basal aquifer remedy, and 3) that no groundwater extraction wells have been installed that would interfere with the basal aquifer remedy.

The State of Hawaii Department of Land and Natural Resources (specifically, the State Water Use Commission) shall be notified of the extent of the downgradient plume and requested not to permit any new extraction from the vicinity of the basal aquifer downgradient plume or source area without prior approval from EPA. (An annual review of State of Hawaii Department of Land and Natural Resources files may be conducted or a notice mechanism may be agreed upon between the State and EPA.)

Land use restrictions shall be put in place requiring the following:

- The owner must give notice of all institutional controls to any lessees of any portion of the Site.
- The owner must give 6 months prior notice to EPA before any sale of any portion of the Site.
- The owner must identify to EPA all lessees on any portion of the Site within 30 days of such lessees occupying any portion of the Site.
- Without prior review and written approval by EPA, the owner of the Kunia Section of the Site shall not undertake, allow or consent to installation of groundwater extraction wells that will interfere with the remedy.
- Without prior review and written approval by EPA, the owner of the Kunia Section of the Site shall not undertake, allow or consent to activities which damage or interfere with the groundwater monitoring or extraction wells or any component associated with the remedy.
- To minimize interference with the remedial action, the owner of the Kunia Section of the Site shall not allow any change in the current use of the land, i.e., from pineapple farming, to commercial, other industrial or residential use, until phase two of the downgradient plume portion of the basal aquifer remedy has been implemented and post-operation monitoring is complete.

Basal Aquifer Contingent Point-of-Use Treatment Performance Criteria

It is not anticipated that any additional existing wells are at risk of becoming impacted by COCs from the Del Monte Site. However, in the unlikely event that a drinking water well becomes impacted by contamination from the Del Monte Site, point-of-use treatment would be implemented for the contaminated well or wells. The performance standard or action level for implementing the contingent point-of-use treatment is detection of COCs in a drinking water well at or above one half of the MCLs groundwater cleanup standards.

A sentinel monitoring well located upgradient of the nearest downgradient drinking water well (or wells) will be used to provide early warning of potential impacts to drinking wells.

Physical treatment, consisting of air stripping and/or carbon adsorption, would be used if this contingency is implemented. The performance of the point-of-use treatment unit would be monitored in accordance with State of Hawaii monitoring requirements for drinking water sources.

11.2 Summary of the Estimated Remedy Costs

A detailed breakdown of the estimated capital, O&M, and present worth costs associated with the selected remedy is included in Table 14. As shown in this table, the following is included in the estimated capital cost for this alternative:

Capital Costs

- Mobilization, site preparation, demobilization
- Earthwork: pit backfill (existing) and cap construction
- Installation of fencing to restrict site access
- Perched aquifer groundwater extraction system (existing)
- Dedicated pumps for perched aquifer monitoring wells
- Phytoremediation system (existing)
- SVE system installation
- Contingency for Resource Conservation and Recovery Act (RCRA) compliance
- Contractor overhead and profit
- Engineering and construction surveillance

As shown in these tables, the following is included in the estimated O&M cost for this alternative:

O&M Costs

- Labor for operation of the remediation systems
- Labor, equipment, and supplies to maintain the remediation systems
- Labor, equipment, and supplies to inspect and maintain the soil cap
- Labor for obtaining samples to monitor phytoremediation system performance (air, soil, and water) and for perched groundwater monitoring
- Laboratory analytical costs for monitoring
- Electricity (primarily SVE blower and groundwater pumping)
- Carbon regeneration/disposal for SVE off-gas treatment
- Fencing inspection and maintenance

- Supplies and miscellaneous consumables for operation, maintenance, and monitoring
- Data compilation, evaluation, and reporting
- Monitoring of Institutional Controls

The information in this cost estimate summary table (Table 14) is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the selected remedy. Major changes may be documented in the form of a memorandum in the Administrative Record file, and Explanation of Significant Differences (ESD) or a ROD Amendment. This is an order-of-magnitude engineering cost estimate this is expected to be within +50 to -30 percent (%) of the actual project cost.

The present worth cost estimates assume a 5 % discount rate and a 5- (downgradient plume components) to 10-year project duration. The total estimated capital costs range from $5.73 million to $10.19 million. The low end of the range assumes that phase two of the basal aquifer remedy consists of monitored natural attenuation. The upper end of the estimated remedy costs assumes that phase two includes full extraction and treatment for the downgradient plume. The present worth of the perched aquifer O&M is $1.59 million. The present worth of the basal aquifer O&M ranges from $5.58 to $9.17 million for monitored natural attenuation and full-scale pumping, respectively. The total present worth cost estimate for the remedy ranges from $12.9 million (monitored natural attenuation) to $21.0 million (full-scale downgradient pumping). These total estimated costs do not include the capital or O&M costs of the contingent point-of-use treatment unit. Costs have been estimated for this in the unlikely event that this contingent system is needed. The estimated capital cost is $1.77 million and the present worth of the annual O&M is $2.70 million, assuming 10 years of operation. If implemented along with the phase two downgradient pump-and-treat, this contingent action could raise the total remedy costs as high as $25.4 million.

11.3 Expected Outcomes of the Selected Remedy

Once completed, this remedy will restore the basal aquifer to unrestricted beneficial use as a source of drinking water supply. COC concentrations will be below the cleanup standards (MCLs) presented in Table 13 and the perched aquifer and deep soils will no longer represent a threat to basal water quality. The remedy is expected to be completed in less than 10 years (although monitoring may be needed for a longer period of time) after which unrestricted use of the land and groundwater will be available at the Del Monte Site.

12 Applicable or Relevant and Appropriate Requirements (ARARs)

Section 121(d) of CERCLA, 42 U.S.C. § 9621(d) requires that remedial actions at CERCLA sites attain (or justify the waiver of) any federal or state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate. These applicable or relevant and appropriate requirements are referred to as "ARARs." Federal ARARs may include requirements promulgated under any federal environmental laws. State ARARs may only include promulgated, enforceable environmental or facility-siting laws of general application that are more stringent or broader in scope than federal requirements and that are identified by the state in a timely manner.

An ARAR may be either "applicable," or "relevant and appropriate," but not both. If there is no specific federal or state ARAR for a particular chemical or remedial action, or if the existing ARARs are not considered sufficiently protective, then other guidance or criteria to be considered (TBCs) may be identified and used to ensure the protection of public health and the environment. The NCP, 40 C.F.R. Part 300, defines "applicable," "relevant and appropriate," and "to be considered" as follows:

- **Applicable requirements** are those cleanup standards, standards of control, or other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.

- **Relevant and appropriate requirements** are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and that are more stringent than federal requirements may be relevant and appropriate.

- **TBCs** consist of advisories, criteria, or guidance that EPA, other federal agencies, or states developed that may be useful in developing CERCLA remedies. The TBC values and guidelines may be used as EPA deems appropriate. Once a TBC is adopted, it becomes an enforceable requirement.

ARARs are identified on a site-specific basis from information about the chemicals at the site, the remedial actions contemplated, the physical characteristics of the site, and other appropriate factors. ARARs include only substantive, not administrative, requirements, and pertain only to onsite activities. Section 121(e) of CERCLA, U.S.C. 9621(e), states that no federal, state or local permit is required for remedial actions conducted entirely on-site. Offsite activities, however, must comply with all applicable federal, state, and local laws, including both substantive and administrative requirements, that are in effect when the activity takes place. There are three general categories of ARARs:

- **Chemical-specific** ARARs are health- or risk-based concentration limits, numerical values, or methodologies for various environmental media (i.e., groundwater, surface water, air, and soil) that are established for a specific chemical that may be present in a specific media at the site, or that may be discharged to the site during remedial activities. These ARARs set limits on concentrations of specific hazardous substances, pollutants, and contaminants in the environment. Examples of this type of ARAR include state and federal drinking water standards.

- **Location-specific** ARARs set restrictions on certain types of activities based on site characteristics. Federal and state location-specific ARARs are restrictions placed on the concentration of a contaminant or the activities to be conducted because they are in a specific location. Examples of special locations possibly requiring ARARs may include flood plains, wetlands, historic places, and sensitive ecosystems or habitats.

- **Action-specific** ARARs are technology- or activity-based requirements that are triggered by the specific type of remedial activities selected. Examples of this type of ARAR are RCRA regulations for waste treatment, storage, or disposal.

EPA has evaluated and identified the ARARs for the selected remedy in accordance with CERCLA, the NCP, and EPA guidance, including the CERCLA Compliance with Other Laws Manual, Part I (Interim Final), OSWER Directive 9234.1-01 (EPA, 1988a) and CERCLA Compliance with Other Laws Manual, Part II, OSWER Directive 9234.1-02 (EPA, 1989). Tables 14 (chemical-specific) and 15 (action-specific) present the ARARs for the perched aquifer and basal aquifer components of the remedy.

It should be noted that for RCRA regulations, the Hawaii Administrative Rules (HAR) Title 11 and certain provisions in Chapters 261 through 267 are either applicable or relevant and appropriate federal ARARs for the perched aquifer and the basal aquifer. These provisions are considered a federal ARAR because they were approved by EPA in its November 1, 2001 authorization of the State of Hawaii's RCRA program and are federally enforceable.

12.1 Chemical-Specific ARARs

Table 15 summarizes the chemical-specific ARARs for the selected remedy. The COCs for the Del Monte Site are compounds that have been detected in groundwater (basal and perched) in the Kunia Village source area. Table 13 lists these compounds and their selected cleanup levels based on the chemical-specific ARARs.

12.1.1 Chemical-Specific ARARs - Perched Aquifer

Safe Drinking Water Act (SDWA)

The impacted perched groundwater is not a current or potential future source of drinking water, and therefore the SDWA requirements are not an ARAR for the perched groundwater. The perched groundwater at the Kunia Village Area is only present locally, and does not provide sufficient sustainable yield to provide for use as a water supply. The EPA groundwater policy set forth in the NCP preamble uses the system in EPA Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy (NCP, 55 Fed. Reg. 8752–8756). Under this policy, groundwater is classified in one of three categories (Class I, II, or III) based on ecological importance, its ability to be replaced, and vulnerability. Class I is irreplaceable groundwater currently used by a substantial population, or groundwater that supports a vital habitat. Class II consists of groundwater currently used or that might be used as a source of drinking water in the future. Class III is groundwater that cannot be used for drinking water because of its unacceptable natural quality or insufficient quantity. In accordance with the EPA guidelines, sufficient yield for a typical household is a minimum of 150 gallons per day. However, as demonstrated during the phytoremediation treatability study, regular pumping of the perched aquifer extraction wells is dewatering the perched zone. Actual pumping rates achievable during September 1999 for the phytoremediation treatability study show that all 14 extraction wells only produced 1865 gallons per week (133 gal/well/week), and several of the wells have been completely dewatered. The perched aquifer has continued to be dewatered even following rainfall events. In the period between the weeks ending January 23, 2000 through April 9, 2000 the average production from the 7 extraction wells still producing was only 39.2 gal/day. The other 7 wells have been dewatered. The perched aquifer in the Kunia Village area is classified as a Class III aquifer. Therefore, drinking water standards are neither applicable nor relevant and appropriate for the perched groundwater. However, because perched groundwater eventually recharges the basal aquifer, the impacts from the perched groundwater to the basal groundwater have to be evaluated.

RCRA Hazardous Waste Definition Standards

RCRA standards (HAR Title 11) are applicable federal ARARs for determining whether soil from well construction or groundwater extracted from the perched aquifer is a hazardous waste. The soil and extracted groundwater will be considered a hazardous waste if it contains elevated levels of the site COCs because of the "contained-in" policy. The policy states that materials contaminated with hazardous waste are considered hazardous waste if they contain a listed waste or if they meet specified criteria, including exceedances of the Toxicity Characteristic Leaching Procedure (TCLP) maximum concentrations.

12.1.2 Chemical-Specific ARARs - Basal Aquifer

Water Quality Protection Plan

Under the SDWA and RCRA, a significant issue in identifying ARARs for groundwater is whether the groundwater can be classified as a source of drinking water. The EPA groundwater policy set forth in the NCP preamble uses the system in EPA Guidelines for Groundwater Classification under the EPA Groundwater Protection Strategy (NCP, 55 Fed. Reg. 8752–8756). Under this policy, groundwater is classified in one of three categories (Class I, II, or III) based on ecological importance, its ability to be replaced, and vulnerability. Class I is irreplaceable groundwater currently used by a substantial population, or groundwater that supports a vital habitat. Class II consists of groundwater currently used or that might be used as a source of drinking water in the future. Class III is groundwater that cannot be used for drinking water because of its unacceptable quality (e.g., high salinity or widespread naturally occurring contamination) or insufficient quantity. The basal aquifer at the Site can be classified as a Class II aquifer and is a potential source of drinking water

Safe Drinking Water Act

MCLs under the SDWA are relevant and appropriate requirements for aquifers with Class I and II characteristics and, therefore, are federal ARARs. The point of compliance for MCLs under the SDWA is at the tap. For CERCLA remedies, however, EPA indicates that MCLs should be attained throughout the contaminated plume, or at and beyond the edge of the waste management area when the waste is left in place (55 Fed. Reg. 8753). At the Del Monte Site, MCLs are cleanup levels throughout the basal aquifer plume, both in the Kunia Village source area and downgradient (see Table 13 for a listing of the MCLs/cleanup levels).

RCRA Hazardous Waste Definition Standards

RCRA regulations are applicable federal ARARs for determining whether the extracted basal groundwater is a hazardous waste. Because the extracted water is likely to contain a listed hazardous waste, it is likely to be classified as hazardous in accordance with the "contained in" policy. The contained-in policy states that materials contaminated with a listed hazardous waste or meeting the characteristic criteria are considered hazardous waste. It is not anticipated that the basal groundwater would meet the characteristic criteria to be considered a hazardous waste. However, if necessary, the extracted groundwater will be tested to determine whether it is hazardous waste in accordance with these regulations.

RCRA Groundwater Protection Standards

RCRA regulations (HAR Title 11, Chapter 264-94) state that concentration limits for RCRA groundwater protection standards are set for RCRA-regulated units. These regulations provide that compounds must not exceed their background levels in groundwater or some higher concentration limit set as part of the corrective action program. A limit greater than background may be approved if the owner can demonstrate that it is not technologically or economically feasible to achieve the background value and that the constituent at levels greater than background will not pose a hazard to human health or the environment. A concentration limit greater than background must never exceed other applicable standards including MCLs established under the federal SDWA. As is stated above, MCLs have selected for the cleanup levels in the basal aquifer. EPA has determined that these cleanup levels reflect the current and potential use and exposure at the site

The RCRA groundwater protection standards are applicable only to RCRA-regulated units, and the Del Monte Site is not considered a RCRA-regulated unit. However, the substantive provisions of (HAR 11-264-94 (a)(1), (a)(3), (c), (d). and (e) are deemed relevant and appropriate federal ARARs for groundwater affected by releases from this site because the constituents being addressed are listed RCRA hazardous wastes.

Primary MCLs

National primary drinking water standards for organic compounds are found at 40 C.F.R. § 141.61(a). The federal MCL for DCP has been determined to be a relevant and appropriate requirement for basal groundwater cleanup. Primary State MCLs are set forth in HAR Title 11, Chapter 20 - Potable Water System Regulations. The State MCLs for EDB and DBCP (0.04 μg/l for each) are more stringent than the Federal MCLs (0.05 μg/l and 0.2 μg/l, respectively). In addition, the State of Hawaii has established an MCL for 1,2,3-TCP (0.6 μg/l), whereas the Federal regulations do not include an MCL for this compound. As such, the State MCLs for these three compounds are relevant and appropriate for basal groundwater at the Del Monte Site.

12.1.2 Chemical-Specific ARARs - Soil and Other Solids

There are not any chemical-specific ARARs related to the remediation of deep soil in the perched aquifer. However, soil cuttings will be generated during installation of additional wells in both the perched and basal aquifers. In addition, spent carbon will be generated during groundwater treatment. Hazardous waste determinations will be made for both of these at the time the waste is generated. Assuming that the waste will be hazardous, the action-specific requirements identified below for handling of hazardous wastes would be ARARs.

12.1.3 Chemical-Specific ARARs - Air

There will be discharges to air from both the SVE treatment unit associated with the SVE system treatment unit and from the air stripper associated with the basal aquifer groundwater treatment unit. Hawaii Air Pollution Control Standards (HAR Title 11, Chapter 60) address discharge of air pollution including visible emissions, fugitive dust, incineration, process industries, sulfur oxides from fuel combustion, storage of VOCs, VOC separation from water, and waste gas disposal. The regulation requires permits for point sources and treatment systems that exceed 0.1 tons per year of each hazardous air pollutant. The substantive provisions of these regulations will be applicable for any action that includes air discharges exceeding this threshold. At this stage, it does not appear likely that either the air stripper or the SVE treatment unit will have discharges approaching the 0.1 tons per year threshold.

12.1.4 Chemical-Specific ARARs - Surface Water

There are no planned discharges to surface water as part of the selected remedy at the Del Monte Site. However, if there is a change in the planned discharge option and treated water is going to be discharged to surface water, discharges will need to meet water quality standards.

Water Quality Standards

On 22 December 1992, U.S. EPA promulgated federal water quality standards under the authority of the federal Clean Water Act (CWA) Section 303(c)(4)(B), 33 U.S.C. ch. 26, § 1313 to establish water quality standards required by the CWA where states had failed to do so (57 Fed. Reg. 60848 [1992]). These standards have been amended over the years in the *Federal Register* including the amendments of the National Toxics Rule (60 Fed. Reg. 22228 [1995]). The water quality standards, as amended, are codified at 40 C.F.R. § 131.36. The water quality standards contained in 40 C.F.R. § 131.36(a) are applicable federal ARARs for discharge to surface water.

Discharges to surface water are regulated under the National Pollutant Discharge Elimination System (NPDES) program. The NPDES program has been delegated to the State of Hawaii and is implemented through the Hawaii Water Pollution Control Regulations (HAR Title 11, Chapter 55). While no NPDES permit will be required for any discharge to surface water on-site, such discharge will still have to comply with the substantive requirements of an NPDES permit.

12.2 Location-Specific ARARs

No location-specific laws or regulations have been identified as being either applicable or relevant and appropriate for the Del Monte Site. Location-specific laws and regulations typically apply to wetlands, historic places, and endangered species. The remedial action at this site impacts a zone of perched groundwater within the Kunia Village Area and a portion of the basal groundwater within the Ewa-Kunia aquifer system. There is no physical connection of the perched water with surface water (other than the excavation pit prior to it being backfilled).

12.3 Action-Specific ARARs

ARARs are technology- or activity-based requirements that are triggered by the type of remedial activities selected. Table 16 lists the action-specific ARARs for the selected remedy which include monitoring requirements, waste-generating requirements and requirements for treatment units.

12.3.1 Action-Specific ARARs - Perched Aquifer

Resource Conservation and Recovery Act (RCRA) - HAR Title 11 Chapter 260-268

RCRA provides requirements that address the identification, generation, transport, storage, treatment, and disposal of hazardous waste. These regulations are applicable to hazardous waste generated or managed during response actions. EPA has determined that perched groundwater originating from the Kunia Village source area must be managed as hazardous waste if the groundwater is extracted from the ground during response activities because the water contains EDB (which is a listed hazardous waste if spilled or discarded – hazardous waste ID #U067), DBCP (U066), and DCP (U083). In addition to the extracted groundwater being managed as a hazardous waste because it contains a listed RCRA waste or meets the criteria for characteristic hazardous waste, any treatment residuals (i.e., spent carbon) will also have to be managed as hazardous waste based on these criteria. Soil cuttings generated during installation of wells may also fall into this category if they contain elevated levels of COCs. Additional discussion on hazardous waste definition is included above in Section 12.1.1 and in Table 15.

RCRA Hazardous Waste Characterization, Generation, Storage, Transportation, and Treatment

The RCRA regulations contained in HAR Title 11 Chapter 261 (Identification of Hazardous Waste), Chapter 262 (Regulations for Generators of Hazardous Waste), and Chapter 264 (Regulations for Permitted Hazardous Waste Facilities) are applicable to treatment of extracted perched groundwater and management of treatment residuals (and potentially soil cuttings from drilling). Management and disposal of soil cuttings and treatment residuals shipped to off-site facilities, such as spent carbon sent to an off-site facility for regeneration, would be subject to on-site packaging, labeling, marking, shipping and transportation requirements of HAR Title 11 Chapter 262 (see Table 16).

Because the extracted groundwater contains hazardous waste, the substantive requirements of HAR Title 11 Chapter 264 are applicable for the design, construction, operation, and closure of all facilities associated with the remedial action, including the phytoremediation treatment system. EPA has determined that the phytoremediation treatment system is a RCRA miscellaneous treatment unit and the RCRA miscellaneous treatment unit requirements are applicable.

Monitoring

A groundwater monitoring program will be implemented for the perched aquifer. The monitoring program will meet the substantive requirements of the RCRA general groundwater monitoring standards presented in HAR Title 11 Chapter 264-97. Evaluation monitoring and corrective action will be performed in accordance with Chapter 264-99 and 264-100. A point of compliance has not been designated for the Del Monte Site because waste is not being left in place. Cleanup goals apply to all portions of the perched groundwater plume.

12.3.2 Action-Specific ARARs - Basal Aquifer

All of the ARARs cited in Section 12.3.1 for the perched aquifer also apply to the basal aquifer. In addition, the following ARARs are specific to the basal aquifer component of the remedy.

Federal Insecticide, Fungicide, and Rodenticide Act § 3 and 40 CFR Part 152 Subparts C and D

This section of the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) requires registration of pesticides and includes requirements for labeling and use restrictions. Use restrictions have been included on pesticide formulations containing 1,3 dichloropropene (including Telone II®, which is used by Del Monte on the Oahu plantation), that stipulate such formulations cannot be used within 100 feet of a water well. Therefore, this requirement will mandate that a buffer zone be established around monitoring, extraction or injection wells installed in or near pineapple fields as part of the remedial action.

Underground Injection Control Program (40 CFR Part 144)

The Underground Injection Control (UIC) Program provides regulations and permitting requirements for five general classes of injection wells. These regulations would be applicable to use of groundwater injection wells for recharge of treated groundwater. Although injection wells are not currently planned, if the volumes of water that need to be extracted from the basal aquifer as part of the remedy exceed Del Monte’s water rights injection may become necessary. The injection wells would be considered Class V injection wells. EPA maintains primary enforcement authority for the UIC program under 40 CFR Part 144.

12.4 ARARs Waivers

This remedial action shall comply with all ARARs described in this section. EPA does not anticipate the need for any waivers of ARARs for implementation of the selected remedy.

13 Statutory Determinations

Under CERCLA Section 121, EPA must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ, as a principal element, treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes. The following sections discuss how the selected remedy meets these statutory requirements.

13.1 Protection of Human Health and the Environment

The selected remedy will protect human health and the environment by providing perched aquifer and basal aquifer source control to limit further migration of contaminated groundwater away from the Kunia Village area and preventing the existing downgradient basal aquifer groundwater contamination from impacting current and future groundwater users through either monitored natural attenuation or groundwater extraction and treatment. The remedy provides an additional layer of human health protection by including contingent point-of-use treatment in the unlikely event that any drinking water supply wells become impacted by contaminants from the Del Monte Site in the future.

The selected remedy will remove all Del Monte Site contamination in excess of drinking water standards from the basal aquifer within 10 years allowing for unrestricted use of the aquifer and eliminating the potential for future exposure to site contaminants. The remedy will also remove contaminant mass from the perched aquifer source area, such that the perched aquifer no longer represents a threat to the basal aquifer. Available treatment technologies are technically feasible and proven effective in meeting ARARs for VOCs in the treated groundwater and air. Implementation of the remedy will not pose unacceptable short-term risks. In addition, no adverse cross-media impacts are expected.

13.2 Compliance with ARARs

The selected remedy shall comply with all ARARs described in Section 12 of this ROD. This includes restoration of the basal aquifer to below the chemical-specific cleanup standards listed in Table 13.

13.3 Cost-Effectiveness

EPA believes the selected remedy is cost-effective and represents a reasonable value for the money to be spent. Section 300.430(f)(ii)(D) of the NCP requires EPA to determine cost-effectiveness by evaluating the cost of an alternative relative to its overall effectiveness. Effectiveness is defined by three of the five balancing criteria: long-term effectiveness, short-term effectiveness, and reduction of toxicity, mobility and volume through treatment. The overall effectiveness is then compared to cost to ensure that the selected remedy is cost-effective.

The estimated present worth cost of the selected remedy ranges from $12.9 million to $25.4 million, depending on which phase two action (monitored natural attenuation or groundwater extraction and treatment) is implemented and on the need for the contingent point-of-use treatment. If monitoring data indicate that groundwater and contaminant conditions are favorable, EPA's goal is to implement the monitored natural attenuation action for the downgradient plume, which will result in the costs being at the lower end of the range presented above. Evaluations completed during the RI/FS indicate that the monitored natural attenuation action can provide an overall level of protection and cleanup time comparable to the more expensive downgradient groundwater extraction and treatment action.

13.4 Utilization of Permanent Solutions and Alternative Treatment Technologies to the Maximum Extent Practicable

EPA has determined that the selected remedy represents the maximum extent to which permanent solutions and treatment technologies can be utilized in a practicable manner at the Del Monte Site. EPA has also determined that the selected remedy provides the best balance of tradeoffs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and considering state and community acceptance.

The selected remedy provides source control and mass removal that will achieve significant reductions in source area contaminant concentrations in soil (a principal threat waste), perched groundwater and basal groundwater. The selected remedy satisfies the long-term effectiveness criterion by removing contamination from the source area groundwater and destroying the COCs during carbon regeneration. Groundwater containment through extraction in the source area, in conjunction with downgradient monitoring of natural attenuation, effectively reduces the mobility and volume of and potential for exposure to site-related contamination. The selected remedy does not present any short-term risks that can not be readily mitigated and there are no special implementability issues associated with the selected remedy.

The phytoremediation treatment system is an innovative technology that satisfies EPA's goal of using alternative technologies to the maximum extent practicable. The phytoremediation treatment is also beneficial in that it does not require disposal of the treated water and it does not generate wastes that require special management or disposal.

13.5 Preference for Treatment as a Principal Element

By treating the contaminated soil using SVE, the extracted soil vapor using carbon adsorption, and the extracted groundwater using air stripping and liquid-phase carbon adsorption, the selected remedy addresses the site contamination through the use of treatment technologies. By using treatment as a significant component of the remedial action, the statutory preference for remedies that employ treatment as a principal element is supported.

13.6 Five-Year Reviews

This remedy will not result in hazardous substances, pollutants, or contaminants remaining onsite above levels that allow for unlimited use and unrestricted exposure. However, it will likely take more than five years to attain remedial action objectives and cleanup levels. Accordingly, EPA may conduct a policy review within five years of construction completion for the Site to ensure that the remedy is, or will be, protective of human health and the environment. If it is determined that the remedy is not or will not be protective of human health and the environment, then modifications to the remedy will be evaluated and implemented as necessary.

14 Documentation of Significant Changes

The Proposed Plan for the Del Monte Site was released for public comment in March 2003. The Proposed Plan identified Alternative P3 (Groundwater Extraction and Treatment with Capping and SVE) for the perched aquifer and B3 (Groundwater Extraction and Treatment in the Source Area with Monitored Natural Attenuation of the Downgradient Plume) for the basal aquifer as the Preferred Alternative for addressing contamination at the Del Monte Site. EPA reviewed written and verbal comments submitted during the public comment period. It was determined that no significant changes to the remedy, as originally identified in the Proposed Plan, were necessary.

Part III
Responsiveness Summary

Part III – Responsiveness Summary

This Responsiveness Summary portion of the Record of Decision (ROD) presents the U.S. Environmental Protection Agency's (EPA) responses to the written and significant oral comments received at the public meeting and during the public comment period. The section is divided into responses to written comments and responses to oral comments. Comments are expressed in italics, EPA's responses in plain text.

1 Responses to Written Comments

This section provides responses to written comments received by EPA during the public comment period. Written comments were received from Mr. Roy Arno, a community member.

1.1 Responses to Comments from Mr. Roy Arno, Community Member

Written Comment No. 1. *I felt the presentation was clear and understandable. I used to live in Kunia Village from 1977 - 1988 with no apparent ill effects to myself and my family.*

EPA's Response. Thank you for your comment.

2 Responses to Oral Comments

In this section, EPA provides responses to the formal oral comments received at the public meeting held on April 2, 2003. Formal oral comments were received from five parties: Mr. Henry Curtis, representing Life of the Land; Ms. Audrey Hyrne, a community member; Mr. Marcus Oshiro, a member of the Hawaii State House of Representatives (39th Representative District); Ms. Kat Brady, representing Life of the Land, and Ms. Kathy Masunaga, a community member. The full transcript of the public meeting is available at EPA's Superfund Records Center at EPA's Regional Office in San Francisco, and locally at the information repository at the Wahiawa Library.

2.1 Responses to Comments from Mr. Henry Curtis, Life of the Land

Mr. Curtis Comment No. 1, Transcript Page 15, Line 24. *We would like to know where the dirt was moved to that came out of the site area, since we have been to two EPA presentations before and got different answers at each one.*

EPA's Response. As reported in the Final RI report dated November 6, 1998, Del Monte excavated 2,000 tons of soil in 1981 and 16,000 tons of soil in 1983 from the Kunia Village spill area. The soil was spread in a thin layer over an approximately 20 acre pineapple field in Del Monte Field 8 which is located about 1,700 feet west of Kunia Village (see Figure 12). This action was conducted with approval from the State of Hawaii Department of Health (HDOH) to allow volatilization and natural attenuation of the soil fumigants from the soil. The HDOH rationale for this action was that the soil fumigants were still permitted for agricultural use in pineapple fields at the time. This information was also discussed in EPA’s January 1999 Fact Sheet and at the January 27, 1999 Public Meeting.

Mr. Curtis Comment No. 2, Transcript Page 17, Line 7. *Weren't the pesticides involved banned on the national level before the spill?*

EPA's Response. The spill occurred in April 1977. On September 30, 1983, more than 5 years later, EPA banned the use of EDB as a soil fumigant on agricultural crops. DBCP was banned in 1985.

Mr. Curtis Comment No. 3. Transcript Page 21, Line 2. *You have an estimated location of the Waianae-Koolau unconformity. So you're assuming that you know where the line is, and because the line is there, you know the groundwater will not travel beyond that. What assumptions have you used in assuming where you think it might be?*

EPA's Response. The contact (or unconformity) between the Koolau and Waianae basalts has traditionally been mapped at the land surface at a location about 4,000 feet west of the Kunia Well. However, EPA is more concerned with the location of the contact at the groundwater table surface because that is where the contact serves to block the flow of groundwater from the Waianae basalts to the Koolau basalts. EPA has assumed, consistent with numerous published geologic studies and maps, that the contact between the Koolau and Waianae basalts at the groundwater table lies about 1,000 feet or more east of the Kunia Village area. The geologic rationale behind this assumption is as follows: The Waianae volcano and basalts are older in age than the Koolau basalts. The surface of the Waianae volcano, which slopes downhill about 3 to 10 degrees to the east, was already present when the younger Koolau volcano was erupting and growing to the east. As the Koolau volcano grew, its lava flowed over and buried the existing slope of the Waianae volcano in the vicinity of present day Kunia village. Therefore, the unconformity between the Waianae and Koolau basalts is now a buried slope, which dips about 3 to 10 degrees to the east, beneath Kunia Village. Where this buried slope intersects the groundwater table, which lies approximately at sea level (about 800 feet beneath the land surface) is the hydrogeologic barrier between the Koolau and Waianae basalts. If a slope of 10 degree is assumed for the unconformity, the sea level elevation contact between the Koolau and Waianae is about 1,000 feet east of the Kunia Village area. If a slope of 3 degrees is assumed, the sea level contact would be several thousand feet further east of Kunia Village.

2.2 Responses to Comments from Ms. Audrey Hyrne, Community Member

Ms. Hyrne Comment No. 1- Transcript Page 16, Line 11. *I just want to know who's paying for this. Who's footing the bill for this entire project?*

EPA's Response. At the beginning of the presentation on the Proposed Plan, EPA stated that Del Monte is paying for all costs associated with the investigation and cleanup of the site. Under the terms of the Administrative Order of Consent signed by Del Monte, EPA, and the Hawaii DOH in 1995, Del Monte is liable for all costs to conduct the RI/FS. This also includes reimbursing EPA and DOH for their response and oversight costs during the RI/FS. After this ROD has been signed, EPA will negotiate a Consent Decree that will include a work plan for design and construction of the remedy outlined in the ROD and will specify who will pay. EPA is assuming that Consent Decree negotiations will be conducted solely with Del Monte. However, Del Monte may decide to bring in other potentially responsible parties to share the costs.

Ms. Hyrne Comment No. 2- Transcript Page 16, Line 13. *It was an excellent presentation, Janet, but it's just honestly over the majority of, you know, everyone in Honolulu's head. If I would have brought anyone else here with me that didn't understand what MCL or DBCP or, you know, ethylene dibromide, all these other things that they never heard of before, they're never going to understand this. How are they going to comment on this? I think that maybe we need to have it understood a little more simply, you know. And I know, I've been to your office before, and I know what you have to work with, what you have to deal with. So it's nothing against the plan itself. I'm so happy you guys are here, you know, in 2003.*

EPA's Response. EPA understands that the material is technically complex and has made every effort to present the material in an understandable fashion at public meetings and in “plain language” fact sheets. EPA provides an open-ended time at every community meeting for questions and answers to insure that those in attendance understand the material presented. EPA also publishes the phone number of its Project Manager and its Community Involvement Coordinator, as well as the number of its toll-free message line, in every fact sheet and encourages community members to contact EPA directly to ask questions. EPA appreciates your efforts to attend public meetings, provide comments, and work with us on this important project.

Ms. Hyrne Comment No. 3- Transcript Page 16, Line 25. *But nonetheless, who's paying for all of this? Whose liability is this? Who's the one that said, okay, this 19 million or seven million here or three million there? That's my question.*

EPA's Response. As indicated above, Del Monte agreed to pay all costs associated with development of the remedial alternatives presented in the Proposed Plan. EPA has reviewed and commented on the estimated costs to implement the various remedial alternatives presented in the FS, including the selected remedy, and concurs that the estimated costs are accurately estimated based on the current understanding of site conditions.

Ms. Hyrne Comment No. 4- Transcript Page 20, Line 19. *I'm going to add on to what Mr. Oshiro had said earlier. You know, I know you talked about monitoring. Is that going to include medical monitoring in the future? I know you talked about monitoring. What does that encompass?*

EPA's Response. The monitoring referred to is monitoring of the groundwater plume, treated air and groundwater, remedial systems performance, and other physical aspects of the final remedy. Based on the findings of the Agency for Toxic Substances and Disease Registry (ATSDR) in their February 7, 1995 Public Health Assessment for the site, EPA believes medical monitoring is not necessary. ATSDR concluded the following: “Based on the available information, ATSDR concludes that the people of Kunia were not exposed to significant levels of EDB and DBCP in their drinking water. Therefore, we do not anticipate that the people who drank the Kunia well water will have any adverse health effects.”

2.3 Responses to Comments from Mr. Marcus Oshiro, Hawaii State House of Representatives, District 39

Mr. Oshiro Comment No. 1- Transcript Page 18, Line 2. *Good to see you again. I think the last time we were here was back in '99. I'm glad this thing has moved along. A couple of comments. One, I'll probably be submitting written comments, also. I'll probably slow e-mail -- not e-mail, but snail mail.*

EPA's Response. EPA looks forward to receiving written comments from Mr. Oshiro.

Mr. Oshiro Comment No. 2- Transcript Page 18, Line 7. *On, I think it's on page eight of the plan, for the Remedy Option on the Basal Aquifer, there's three options there, and I think the preference at this time is to go with number two, extraction and treatment, contingent monitored natural attenuation. And then I believe it states that, if it is found that natural attenuation is not occurring, then Alternative 3 will become the preferred remedy. So I guess my comment would be, at what time would that occur? What would be the turning events? And when would that decision be made in the process?*

EPA's Response. As is described in the Selected Remedy section in Part II of this ROD, the basal aquifer remedy will be implemented using a phased approach. During phase one, the source control component will be implemented and the nature and extent of the basal aquifer plume will be characterized. In addition, point-of-compliance monitoring will be initiated. Based on modeling conducted as part of the RI/FS, a distance of 4,500 feet represents the furthest distance downgradient from the source area that groundwater exceeding MCLs could migrate using “worst-case” assumptions. Therefore, 4,500 feet downgradient of the Kunia Village source area is the currently estimated location where point of compliance monitoring will be conducted. If site characterization indicates that the plume has extended further than 4,500 feet downgradient, EPA will evaluate whether to install another point of compliance monitoring point further downgradient and/or implement the basal aquifer downgradient plume extraction and treatment action.

After construction of the phase one monitoring system is complete, routine quarterly monitoring will be conducted to evaluate the downgradient plume and monitor performance of the source control. If no exceedances are detected at the point of compliance well, monitoring during phase one will be conducted for three years to provide sufficient information to select phase two of the remedial action.

If there is sufficient evidence to suggest that natural attenuation, in conjunction with containment of the source area, can be effective at reducing COC concentrations to below MCLs in a reasonable timeframe, phase two will include implementation of contingent monitored natural attenuation. If the data collected during phase one indicate that natural attenuation will not be effective, phase two will include groundwater extraction and treatment for the basal aquifer downgradient plume.

Mr. Oshiro Comment No. 3- Transcript Page 18, Line 18. *The second comment I have would be, in the '99 meeting, we talked about some of the lands north of Wahiawa, the Galbraith lands, about 2200 acres, and the status of those acres where there were found some contamination of some burial sites,* *spill sites in the Poamoho area. I don't see any of those sites discussed in this particular plan. But I would want to know, was final disposition, as far as remediation, done for those particular parcels out in the Poamoho area north of Wahiawa?*

EPA's Response. The Poamoho section is not discussed in the Proposed Plan because the investigations of the Other Potential Source Areas in the Poamoho Section showed low levels of contamination below EPA's health based guidelines. Based on these findings, EPA believes that no cleanup actions are needed. A description of the sampling conducted in the Poamoho Section can be found in the 1998 Remedial Investigation Report and the March 17, 2003 Remedial Investigation Technical Memorandum 02-02, Investigation Results for Additional Other Potential Source Areas.

Mr. Oshiro Comment No. 4- Transcript Page 19, Line 3. *And the third comment I would like to make is, is the consideration of delisting of those particular lands, given their physical distance from the Kunia Well and the areas of the monitoring wells, is the possibility of delisting still being considered by the EPA for those lands north of Wahiawa?*

EPA's Response. EPA was prepared to delist the Poamoho section in 2002, when a former Del Monte employee informed Del Monte that two other potential source areas for pesticide contamination could exist in the Poamoho section. Del Monte investigated those sites, under EPA oversight, in 2002 and 2003. The investigation results indicate that pesticides are not present at concentrations above EPA's health based guidelines. A Notice of Intent to Partially Delete will be published in the Federal Register. If there are no adverse comments during the 30-day pubic comment period, EPA will publish a Notice of Partial Site Deletion in the Federal Register.

2.4 Responses to Comments from Ms. Kat Brady, Life of the Land

Ms. Brady Comment No. 1- Transcript Page 19, Line 12. *I would like to request a community meeting where a discussion could happen, where people could ask questions and have them answered at the meeting. I think it's kind of disingenuous, when people's lives have been impacted by this spill, that you give a dog and pony show, and you ask people to ask questions, but no answers are ever shared. That is not helpful to the community. What is helpful to the community is to understand what this well covers, what the groundwater, how it flows. So we want to see maps of how the groundwater flows, what other areas could be affected, and we want to learn from each other's questions. To have a meeting where people just ask questions, and they get written down, and nobody has the benefit of an answer is not helpful to us. This is about people's lives. And I think the questions that have been asked now about who's paying for it, we're taxpayers, we'd like to know. Are we footing the bill? Who's paying for this? And these are the kinds of things that we need to know. So to have a meeting where it's just talking heads is not helpful to us. And I am hereby formally requesting a meeting where we have a discussion, people can benefit from other people's questions and answers, and that we can actually find out what the impact of this is, what future things we should be worried about, where the chemicals are on the scale of contamination and related to health problems. We want real answers. Thank you.*

EPA's Response. Different opportunities for public comment were explained and provided at the Proposed Plan Public Hearing. Before the presentation on the Proposed Plan began, EPA stated that there would be an opportunity to ask clarifying questions immediately following the presentation. After any clarifying questions had been answered, EPA would take official comments on the Proposed Plan and respond to them in the Responsiveness Summary. A number of community members asked questions after the presentation and EPA responded before moving on to the formal receipt of public comments. EPA staff stayed after the close of the public hearing to talk with community members.

The detailed presentation on the Proposed Plan addressed the issues outlined in this comment such as who is paying for the investigation and cleanup, the direction of groundwater flow, the extent of contamination and risk from the site.

In addition to the Proposed Plan Public Hearing, EPA has conducted a number of community meetings for the Del Monte Site which included an open-ended question and answer session. Before conducting a community meeting in January 1999, EPA met with the residents of Village Park in the home of one of the residents. EPA publishes the phone number of its Project Manager and its Community Involvement Coordinator, as well as the number of its toll-free message line, in every fact sheet and encourages community members to contact EPA to ask questions.

EPA believes that the Del Monte Proposed Plan Public Hearing met the intent of EPA guidance and practice and therefore, does not need to be repeated.

Ms. Brady Comment No. 2- Transcript Page 21, Line 10. *I'm glad you're talking about Risk Assessment. But, you know, that's really more and more becoming problematic for the community. We really prefer the precautionary principle. A Risk Assessment is good, you know, well, it should only hurt, you know, one in a million people. Well, that's fine unless it's your kid who's actually being impacted. So the community more and more is requesting that the government really start looking, erring on the side of precaution. And we are really interested if the EPA ever goes by the precautionary principle and uses that as a measure rather than Risk Assessment, and how you deal with that kind of stuff. I sit on many military restoration advisory boards, and this has been something that we have been talking about for the last year. That's been a big issue in the communities. You know, Risk Assessments don't cut it if our kid is the one person that's going to be harmed. Thank you.*

EPA's Response. EPA fully supports pollution prevention and appreciates the use of precautionary principles; that is why EPA moved to ban the use of EDB as a soil fumigant 20 years ago when it became known that this compound was adversely impacting groundwater supplies in Hawaii, California, and other locations. However, the work at the Del Monte Site to date, including this Proposed Plan, must address contamination resulting from a spill and pesticide handling practices that pre-date the ban on use of EDB. Risk assessments are an appropriate and widely-accepted tool to conservatively evaluate the risks posed to public health and the environment and to help decision-makers make informed and reasonable decisions regarding appropriate uses of resources to efficiently and effectively clean up sites.

2.5 Responses to Comments from Ms. Kathy Masunaga, Community Member

Ms. Masunaga Comment No. 1- Transcript Page 22, Line 10. *Aloha. My name is Kathy Masunaga, and I'm a resident of this community here, and my husband is a retiree of Del Monte Corporation. And just formally, for the record, one of the things that I noticed, Janet, on your presentation was the fact that one of the areas, the trees were really, really tall, so it looks like, to me, even though this is comment on a plan, it looks like things have been done already. And I really want to, you know, commend the company and the government for working together. And I'm sure that, although there are other voices within the community that feel contrary to this, I think I'd like to give you guys and Del Monte a pat on the back. Thank you.*

EPA's Response. Comment acknowledged; thank you.

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Tables

Figures